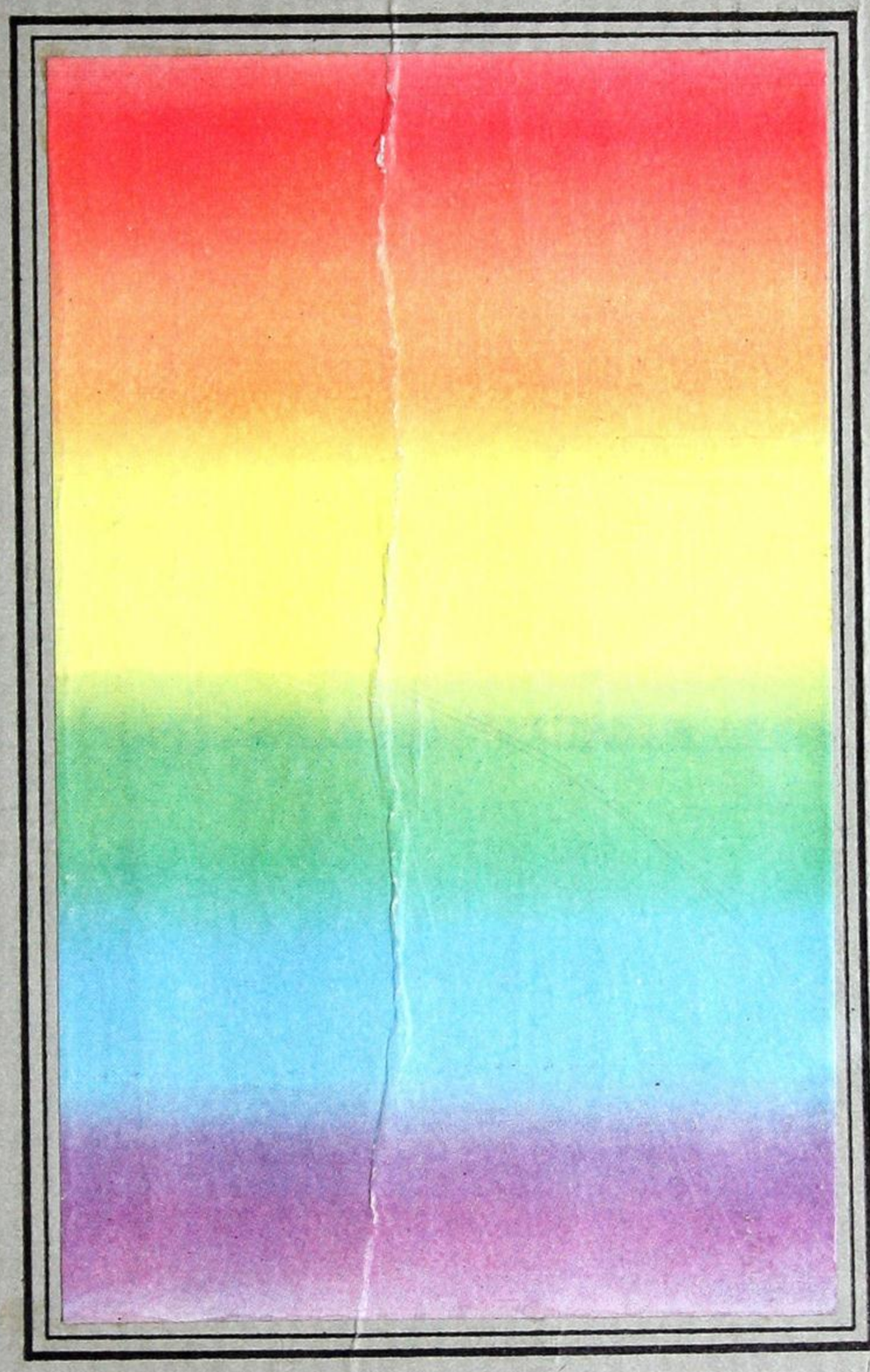
WARD LEONARD VITROHM DIMMERS - THE ACCEPTED STANDARD FOR LIGHTING CONTROL

MOBILE COLOR LIGHTING



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WARD LEONARD ELECTRIC CO.
MOUNT VERNON, N.Y.

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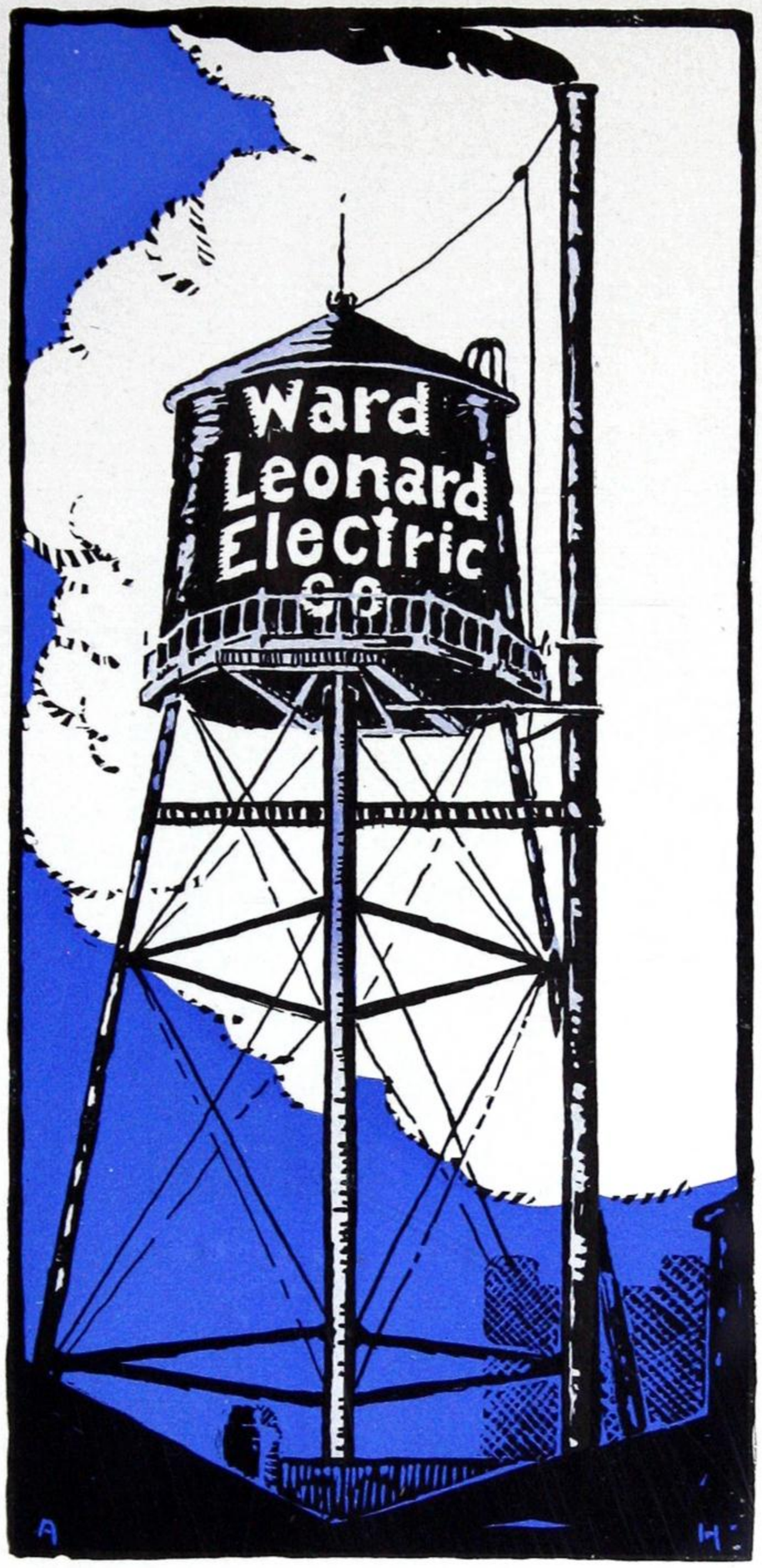

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RADIO RESISTORS AND RHEOSTATS · CIRCUIT BREAKERS

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Mobile Color Lighting

THE USE of changing color lighting to attract attention is relatively new.

The theatre has employed extensively changing, or mobile, color lighting since the introduction of the incandescent lamp and the modern theatre dimmer.

It is mobile color lighting which permits many of the stage's most perfect illusions. The delicacy of a Roxy scene, or the bland perfection of a Joseph Urban setting would be impossible without it.

This bulletin considers, briefly, some part of the ability of mobile color lighting to aid in producing new and unusual publicity. The theatre has obtained its effects by manual control. The following applications, however, give automatic control by a motor and mechanical cams, thereby eliminating the need for a skilled operator in constant attendance.

Five major divisions are presented in which mobile color may be used:

1. Window displays
2. The floodlighting of buildings
3. Illuminated outdoor signs
4. Interior displays
5. Natural phenomena, fountains and gardens

A bulletin of this type does not permit giving in great detail the mechanics of mobile color lighting in all of its applications. That is a matter for the artist and electrician to settle in each specific case.

The services of Ward Leonard engineers are available, however, for aid in the design of mobile color lighting control apparatus.

Mobile Color Lighting

Its Application to the Window Presentation of Merchandise

The Store Window in Selling

ONLY A FEW years ago the display space of store windows was considered by the average merchant in the average store as an excellent place to dump a dust-collecting, indiscriminate exhibit of merchandise. Frequently, the material for sale was placed in a geometric pattern. Flat irons and bread boards, silver ware and clothes line were placed to make a "pretty picture" with an utter disregard for idea association on the part of the window dresser. And, almost invariably, the windows were poorly lighted, or not illuminated at all.

Today, the retail merchant recognizes the potential sales producing ability of his display window as a factor of the utmost importance. The window is the first and most important single direct contact that his store makes with an old customer and establishes with the new customer.

There are many stores in the larger towns and cities where transient trade is a considerable percentage of the business. Stores of this type find that the success or failure of an entire

merchandising plan is directly influenced by the window display. The reason for this is obvious. Steady patrons of a store, while influenced to some extent by external appearances, have a knowledge of the special appeal which the store itself makes to the buyer. Transient trade, on the other hand, places the store much in the position of a box of candy; an attractive cover often leads to an exploration of the box contents.

The extent to which the public will "look" at a window display is determined largely by the amount and kind of light in a window, its disposition, and the merchandise displayed.

A Typical Return Upon Lighting Investment

Mr. M. Luckiesch, Director of the Laboratory of Applied Science at the National Lamp Works of the General Electric Company, one of the country's leading authorities on light and color, cites this example of the influence of light upon sales:

> "A merchant operating a chain of shirt stores in large cities states that they depend to a very great extent upon show windows to attract both transient as well as resident customers. They have found that the use of 'high intensity' window lighting from early in the morning until after midnight, even though the stores were not open in the evening, results in more business than when the windows are artificially lighted only in the evening. They also point to the days of coal conservation during the war when artificial lighting was curtailed. When they cut out the window lighting, business dropped off considerably. When the order was repealed, business picked up immediately.
>
> "This is typical of the opinion of many modern merchandisers operating small stores as individual units or as chains."

The Passing of White Light The use of plain white light alone for the illumination of window displays has practically reached the limit of effectiveness, particularly in the case of stores where much effort is expended upon intensive merchandising. They find that most of the effects which can be had with plain white light have been produced.

The same fault can be found with "still" color lighting. While the use of unchanging color has a very definite place in the proper presentation of window displays, it lacks motion; it is static and lacks the high attention-getting value of mobile color.

The next and most obvious step beyond "still" color lighting is the introduction of mobile color lighting in window displays. The development of the incandescent electric lamp and modern lighting control equipment brought the theatre a new art: the use of mobile color lighting for producing the illusion and force of reality in its scenes.

To the store owner who will grasp the opportunities offered by this new art, color and movement of color brings a clear opening to increased sales by an improved presentation of merchandise.

Window Lighting Costs and Returns Electricity costs money. General managers and store owners demand accurate knowledge of the returns possible by a further increase in current bills and window display preparation costs, before increasing an overhead which is constantly threatening to get out of hand.

To the question of spending more money on window displays, the merchants of this country answer, "yes." A display window consists of a part of the merchant's stock displayed under conditions as favorable to that stock as possible. Like

publication publicity, it affords the merchant an opportunity to display his wares to the public with a minimum of trouble to them. A further parallel between store windows and printed advertisements is found in the fact that the public can disregard entirely the appeal to look, if looking is difficult or not attractive.

Summed up, mobile color used in window displays offers the merchant these advantages:

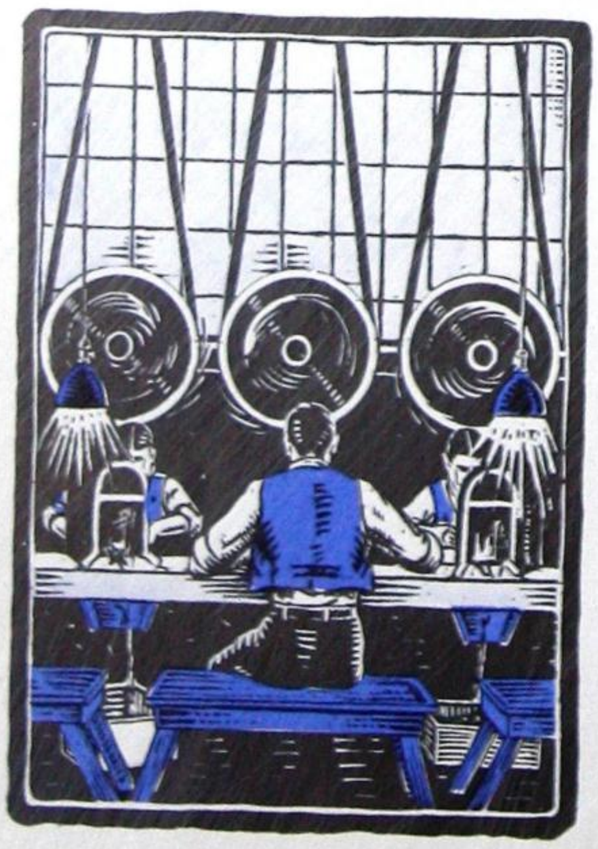
1. The use of mobile color is new. It is an attraction in itself without making the window a side-show.
2. Merchandise is presented with appropriate color accompaniment which emphasizes its worth and attractiveness.
3. The use of mobile color is not confined to large stores. Each window in a store is a unit. The smaller shop merely has a small number of units.

Window display space costs the merchant money exactly as does newspaper space. The return on an investment made in window display is proportionate to the number of people who stop and look at it. *It is to be emphasized again that the extent to which the public will look at a window display is determined by the amount and kind of light in the window, its disposition, and the merchandise display.* It is the attraction of light which commands attention to the window, and it is light properly used that displays merchandise best.

Producing Mobile Color

Mobile color is produced by colored lights controlled by a motor driven cycle dimmer. A cycle dimmer is a device which regulates the light intensity of one or more colors to produce blends and color motion. Such a dimmer consists of one or more dimmer plates each controlling a group of lamp circuits of different colors.

Vitrohm dimmers are not a new development. They are installed in the world's largest theatres and many thousands



of the smaller neighborhood playhouses. The theatre has employed them, manually operated, to produce effects for stage settings. It is possible to apply these principles to window lighting, as many types of display are adaptable to this treatment.

Therefore, it is only necessary to control these dimmers with a proper motor drive to give similar effects in a show window. The scene must be set and lighted properly to attract attention and deliver a message. This leads to a study of the methods to be employed in applying proper motor drive to a bank of dimmers.

A graphic means of expressing color in motion is the color cycle. This is a curve drawn between illumination and time. Typical color cycles are shown in Figures 1 and 4.

The cycle in Figure 1 can be produced with the simplest type of equipment since all mechanical cams can be eliminated by using a special type of dimmer plate. Such a plate is equipped with two dimmer windings and a lever rotating continuously in one direction, and driven by a sprocket mounted directly on the lever shaft (see Fig. 2). The ratings are some-

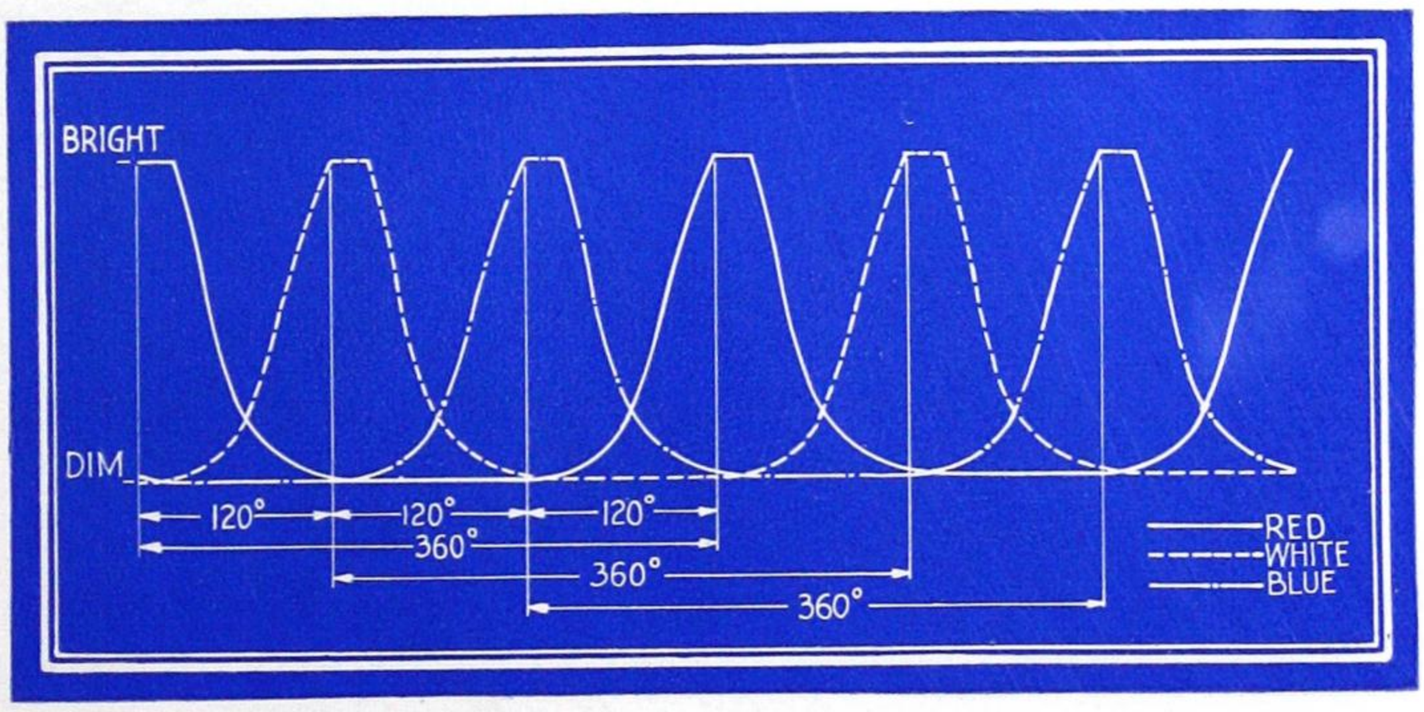


FIGURE 1.
Color cycle produced by cycle dimmer illustrated in Figure 2.

what lower than standard because of the space needed for the extra windings. These ratings for single plates are as follows:

WATTAGE	
MINIMUM	MAXIMUM
500	800
800	1100
1100	1500
1500	1900

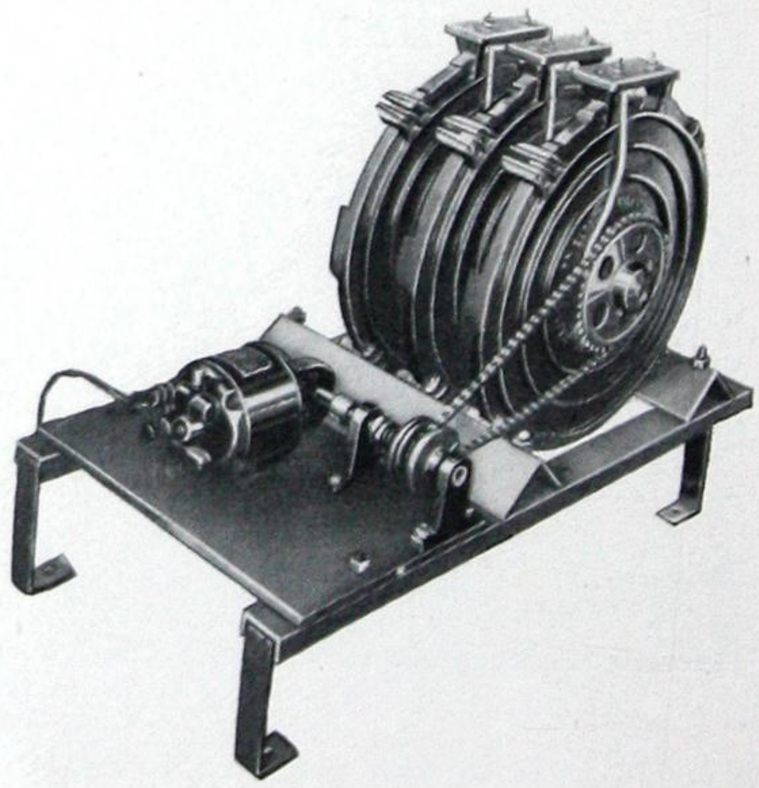
Where larger loads are to be controlled it is possible to use two plates for each color. In these cases it is recommended that each plate be connected to its own load (see page 44). For more than two plates per color the mechanical cam type should be used as described below:

With the mechanical cam type a variety of color cycles is possible. In Figure 3 is shown a dimmer to produce a cycle similar to that in Figure 4.

The color cycles can be varied to suit the specifications of the purchaser by varying the design of the mechanical cam, and the cams can be set at any angle on the shaft so that the sequence of the colors in the cycle may be changed.

FIGURE 2.

Small motor driven cycle dimmer with plates of the continuously rotating type. This dimmer uses no cams, as the levers continually revolve in one direction. High speed and simple construction are thus obtainable, although the wattage capacities are limited. See accompanying text.



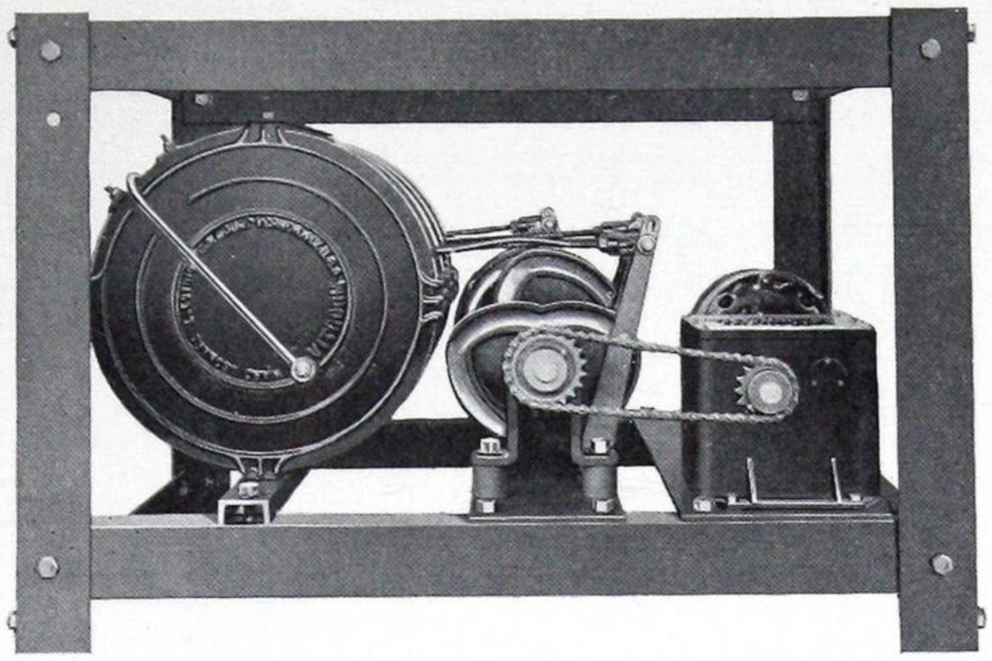


FIGURE 3.

Motor driven cycle dimmer using standard theatre dimmer plates and cam drive. A typical color cycle is illustrated in Figure 4.

It has been found that when three colors or three circuits of lamps are used, that the time for a complete cycle should vary between 15 and 30 seconds in order to attract the passerby. It is also desirable to have 2 to 3 times as much lamp watts in green, red and blue as is used in white or amber because of the higher absorption of the color screens.

In some cases no particular cycle of colors is required, the movement of color being sufficient for display purposes. In these cases, several colors may be controlled by each of the dimmer plates.

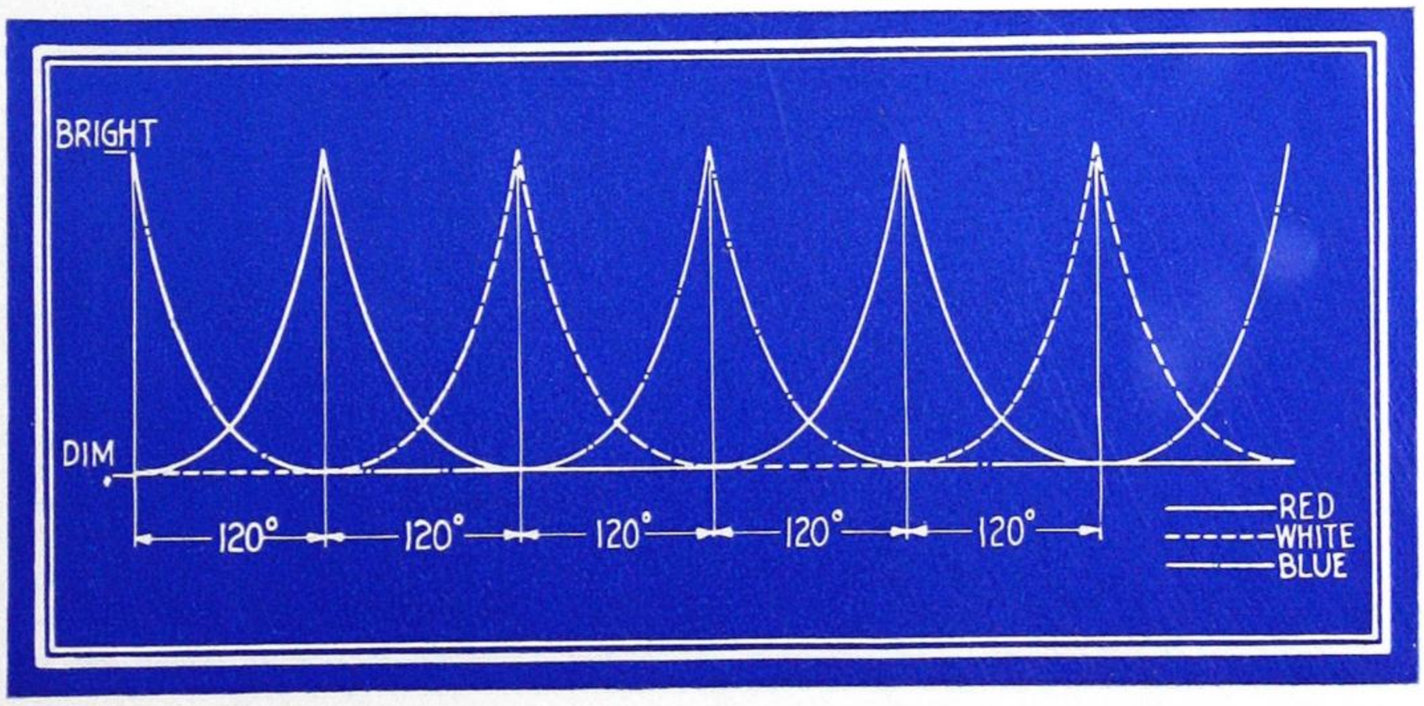


FIGURE 4.

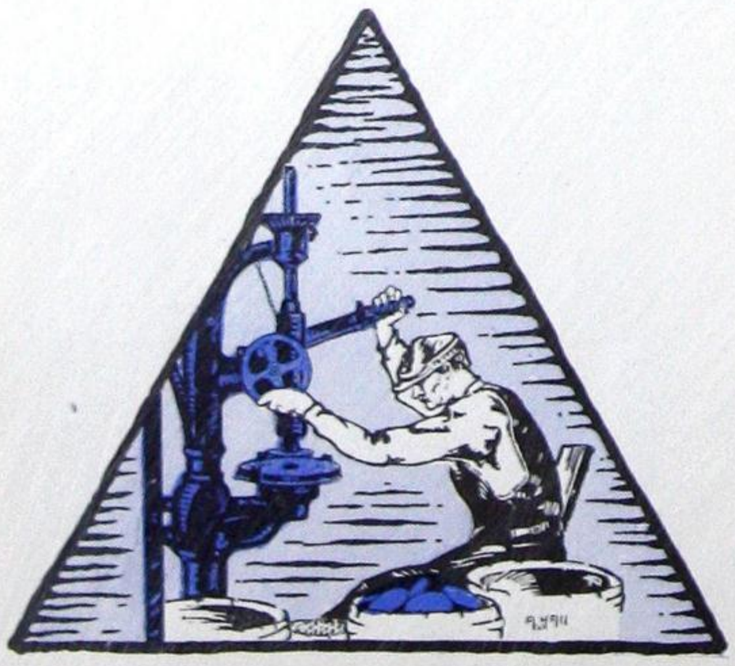
Typical color cycle obtained with motor driven cycle dimmer illustrated in Figure 3. The time ordinates may be made to vary over a wide range.

In larger installations each color may be operated by an individual motor and the color cycle obtained through the use of properly timed flasher contacts to control the motors.

In the types using cams the standard theatre dimmer plates are used. These are made in the following wattages:

NOMINAL	MAXIMUM	MINIMUM
	15″ PLATE	
200	275	150
350	415	280
500	600	420
700	800	605
900	1000	805
1100	1200	1005
1300	1425	1205
1550	1675	1430
1800	2000	1680
	17″ PLATE	
2100	2250	1950
2400	2540	2255
2700	2825	2545
3000	3000	2830
	19″ PLATE	
3300	3400	3005
3600	3680	3405

The rating of the dimmer plate determines the number of lamp watts which it will control most effectively. Where one circuit carries more lamp watts than a single Vitrohm Dimmer plate will control without overheating, two or more dimmer plates are connected in parallel mechanically. The electrical connections of the plates are independent in order to prevent one plate carrying more than its share of the load, in case of slight mechanical variations in alignment. Wiring diagrams of Vitrohm Dimmers connected in accordance with recommended practice are shown on page 44.



The use of spotlights is also effective. Double rating dimmer plates are made for control of such spots. The plates have resistance enough to dim the lower wattage, and capacity enough to carry the higher wattage. The sizes and watt ratings of these plates are as follows:

15″	250-500
15″	300-600
15″	500-1000
17″	750-1500
17″	1000-2000
19″	1500-3000

The dimmer equipment may be placed in any convenient location near the window. If the various branch circuits of each window in a large store are arranged on a suitable magazine panel it is possible to use one cycle dimmer to control any of a series of windows at different times by merely shifting connections.

Glass color caps and gelatin color screens are the most common means of producing color. Gelatin is not durable, as it fades and cracks, and is difficult to handle. Color caps are permanent and easily manipulated. They are snapped over the lamps and fit snugly into the reflector, providing a quick and easy means of getting any color desired in any circuit.

The background of the window should be a light neutral color. For certain displays, such as illustrated on page 16, a draped curtain with a row of reflectors at the top and bottom and close to it, will take the changing colors most effectively. In addition to this, the usual overhead lights in the front of the window illuminate the display. (See diagram, page 17).

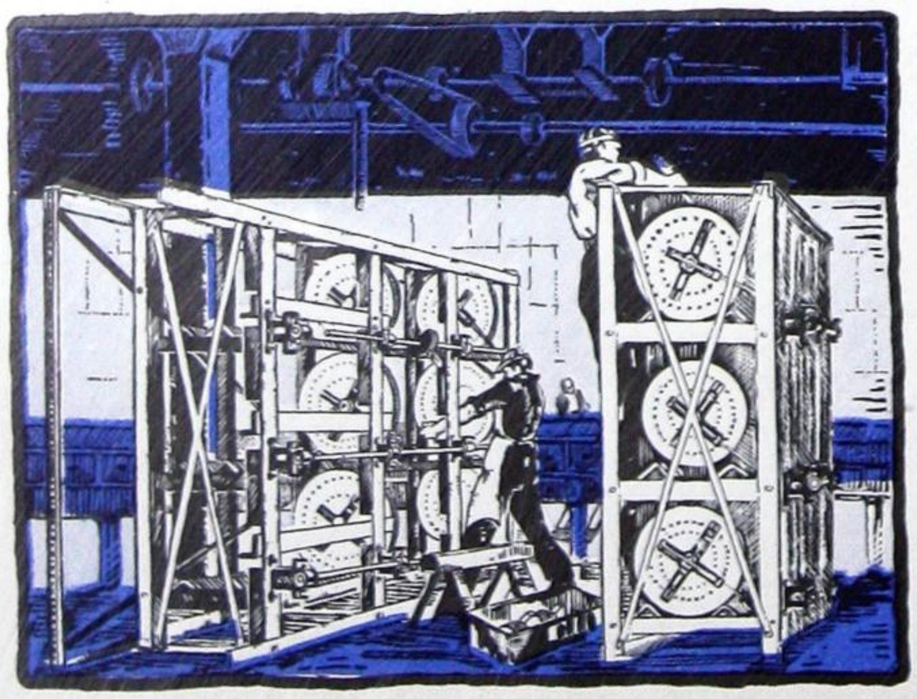
The following information should accompany orders:

1. List of circuits and wattages.
2. Voltage.

3. Two wire or three wire circuit.
4. Number of colors.
5. Color blends desired and their sequence. Give free hand sketch of color blend curve, if possible.
6. Time for a complete color cycle.
7. Kind of current. If alternating, specify frequency.
8. Wiring sketch of circuits in window.

FIGURE 5.

This window is a part of the plan shown in Figure 6 which specifies lighting equipment. The light is controlled by a cycle dimmer in three colors. Such a display is particularly well adapted to this type of treatment. The insert illustrates the method of lighting backgrounds described on Page 15.



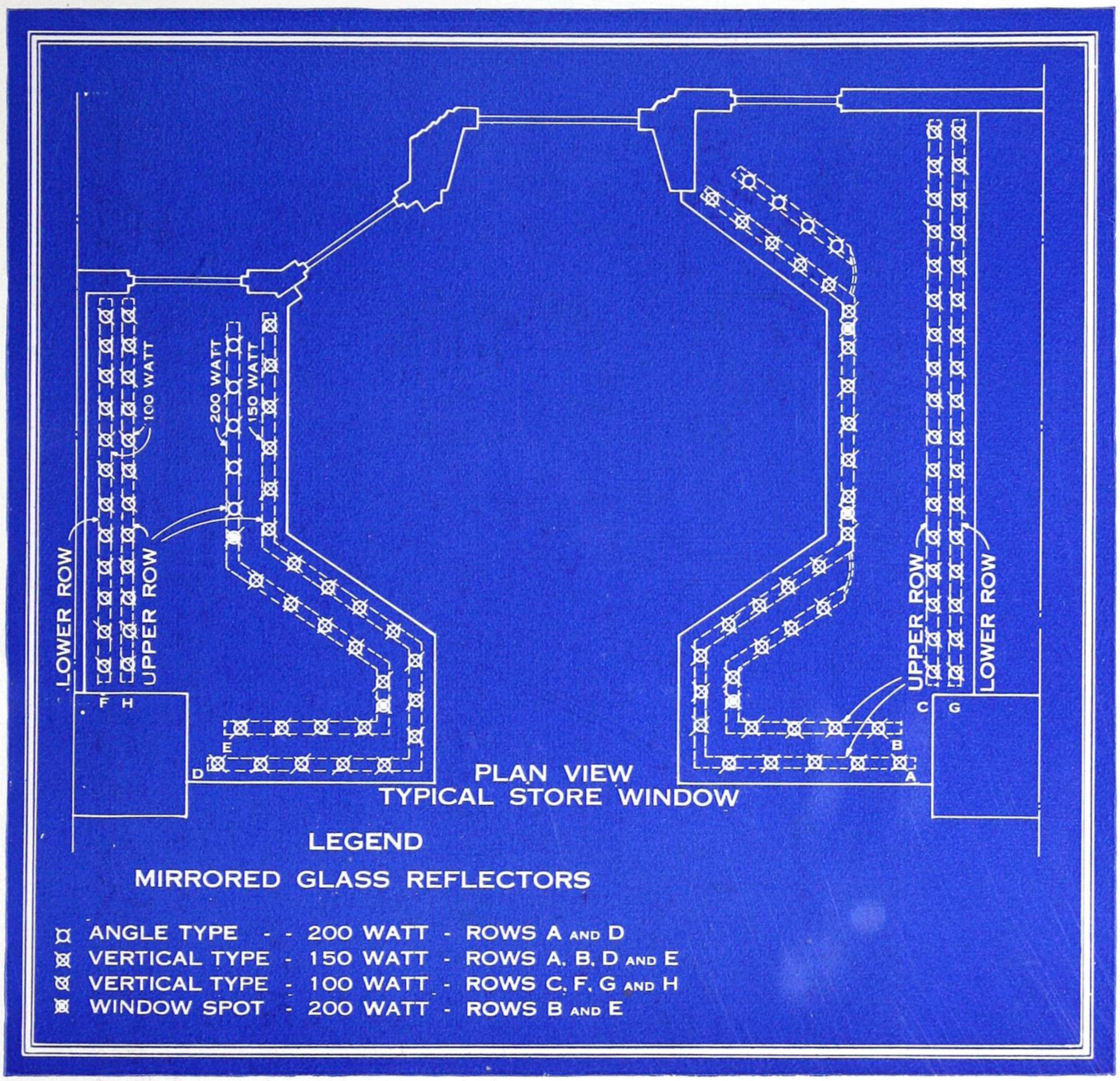


FIGURE 6.

Lighting equipment layout of store window, part of which is shown in Figure 5. The background is illuminated by a row of reflectors close to it, and at the top and bottom. This completely equipped window is typical of many recently installed, and uses to great advantage a motor driven cycle dimmer controlling three colors.

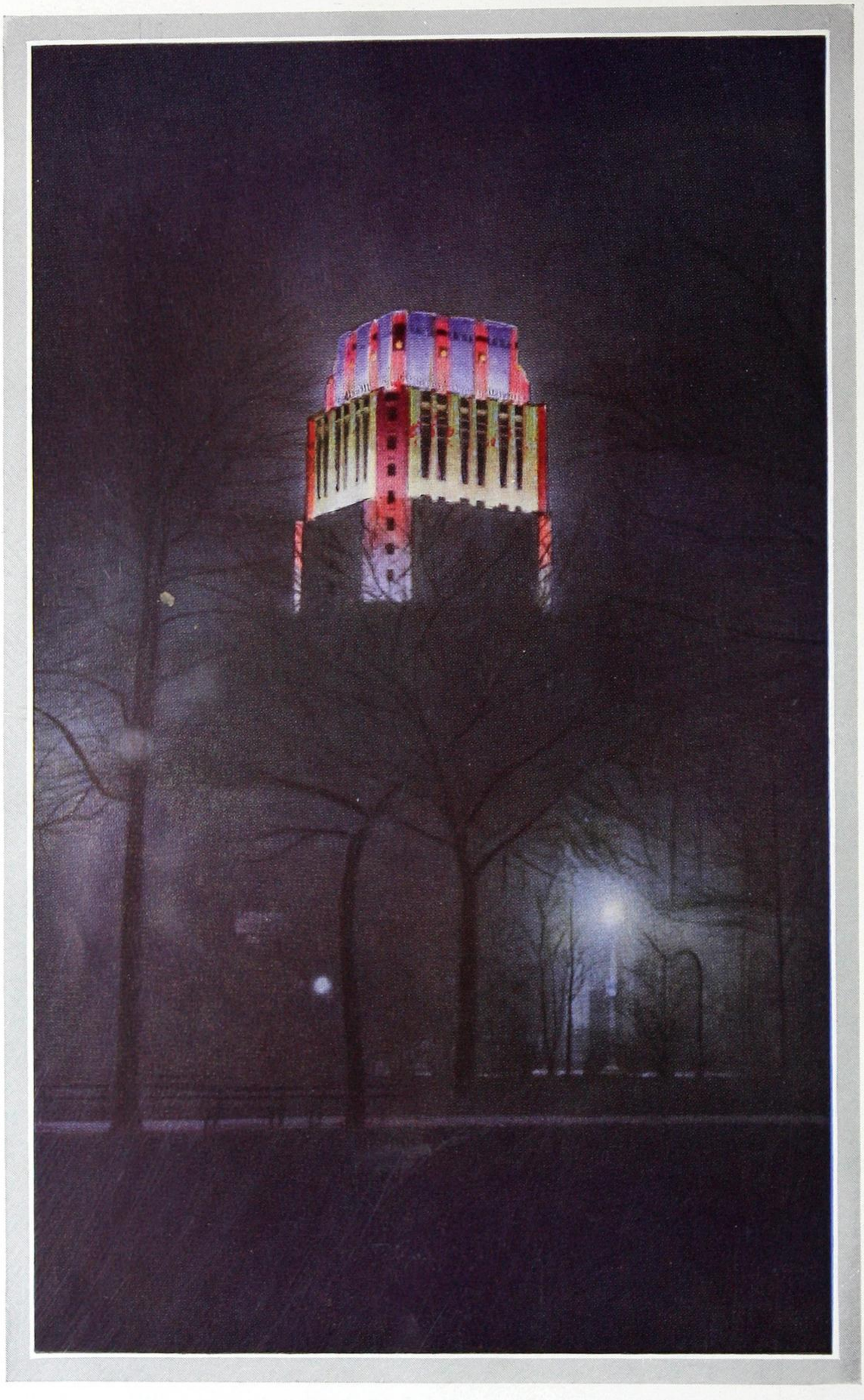
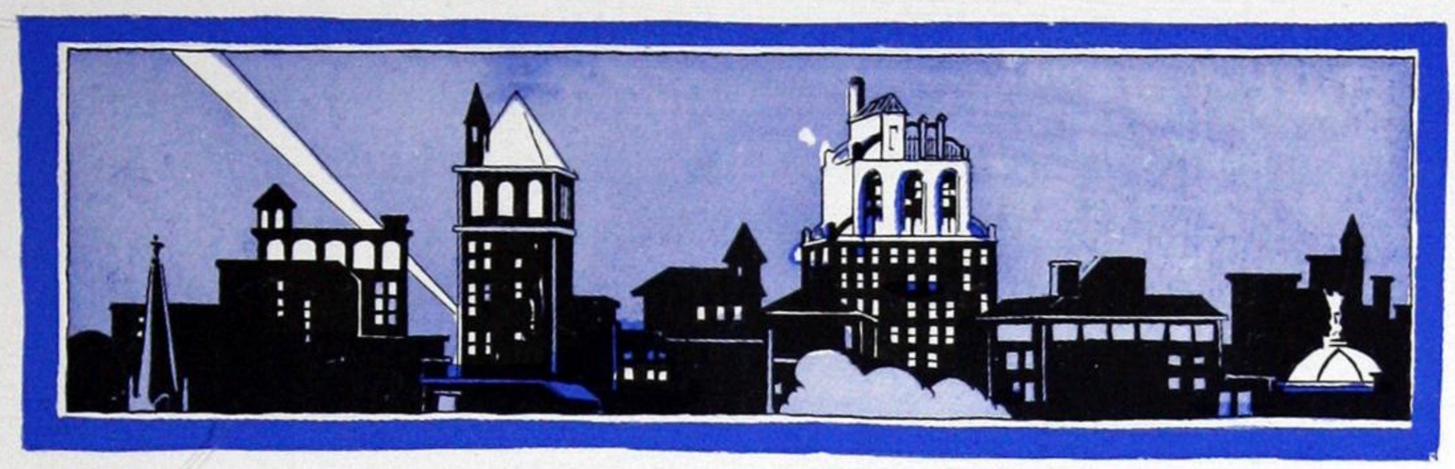


FIGURE 7.

The Philadelphia Electric Company's new building in its cloak of ever changing color. This gives but a faint idea of the appearance of this graceful tower, which pierces the night sky, presenting a slowly changing spectacle of vivid color. A full description of the necessary control apparatus which makes possible the mobile color will be found on the following pages.



Mobile Color Lighting

Its Application to the Floodlighting of Buildings

The Illuminated Building

Mobile color floodlighting offers an ideal publicity medium for the owners and operators of public buildings. The unusual spectacle of a building illuminated in changing colors is attractive and causes much favorable comment.

This medium can be employed by the most conservative business houses with good effect. Properly designed lighting of this character attracts attention and comment, but is not in the least blatant. Banks, conservative business houses, high grade office buildings, public buildings and factories may employ this medium for publicity as more subtle and dignified than some other forms of advertising.

"Individualizing" a Building with Colored Floodlighting

Highly competitive businesses, such as garages, and more particularly gasoline stations, employ mobile color lighting to give individuality to their buildings. One gasoline station is much like another, in the minds of passing motorists, and any device which will attract definite attention to one station attracts business to it.

Limitations Imposed by Conditions It is difficult to lay down any hard and fast rules for determining the adaptability of any building for mobile color lighting, or to give any general plan which would determine the method by which mobile color lighting would be applied best to a building. It may be said in general that most modern buildings of the "skyscraper" type are excellent subjects because of the numerous set-backs. Buildings having domes, unusual facade ornaments, or buildings of peculiar shapes sometimes offer problems which can be met only by a detailed survey of the building by illuminating engineers.

Once the illumination scheme has been decided upon, it is only a matter of providing the proper type of control to provide the change in color desired. Here again the motor driven cycle dimmer is used. Typical color cycles are shown in Figures 1 and 4.

TECHNICAL DATA

The circuits can be laid out to use resistance dimmers of ratings described on page 14. These are suitable for small installations. A larger rating dimmer is made also, known as the Type BD, with ratings as follows:

WATTS	SIZE (IN.)
2000	15 x 24
2500	15 x 24
3000	15 x 24
4000	15 x 24
5000	15 x 24

These can be assembled and controlled by cams in the same manner the round dimmers are controlled (see Fig. 3). These dimmers are provided with fifty steps, which is sufficient for flickerless dimming with the 500, 1000 and 1500 watt lamps ordinarily used in floodlighting. When using these dimmers it

is necessary to break up the circuits into units of 5000 watts or less to eliminate paralleling of dimmer plates. (See Bulletin 72 and page 44).

When it is not possible or economical to use circuits of 5000 watts or less, the reactance type dimmer is recommended. Since this type is more expensive, it is a matter of comparing this added cost with the cost of running extra circuits to the increased number of resistance dimmers of 5000 watts or less. The reactance dimmers are built to control any specified wattage up to 30 KW. in a single unit.

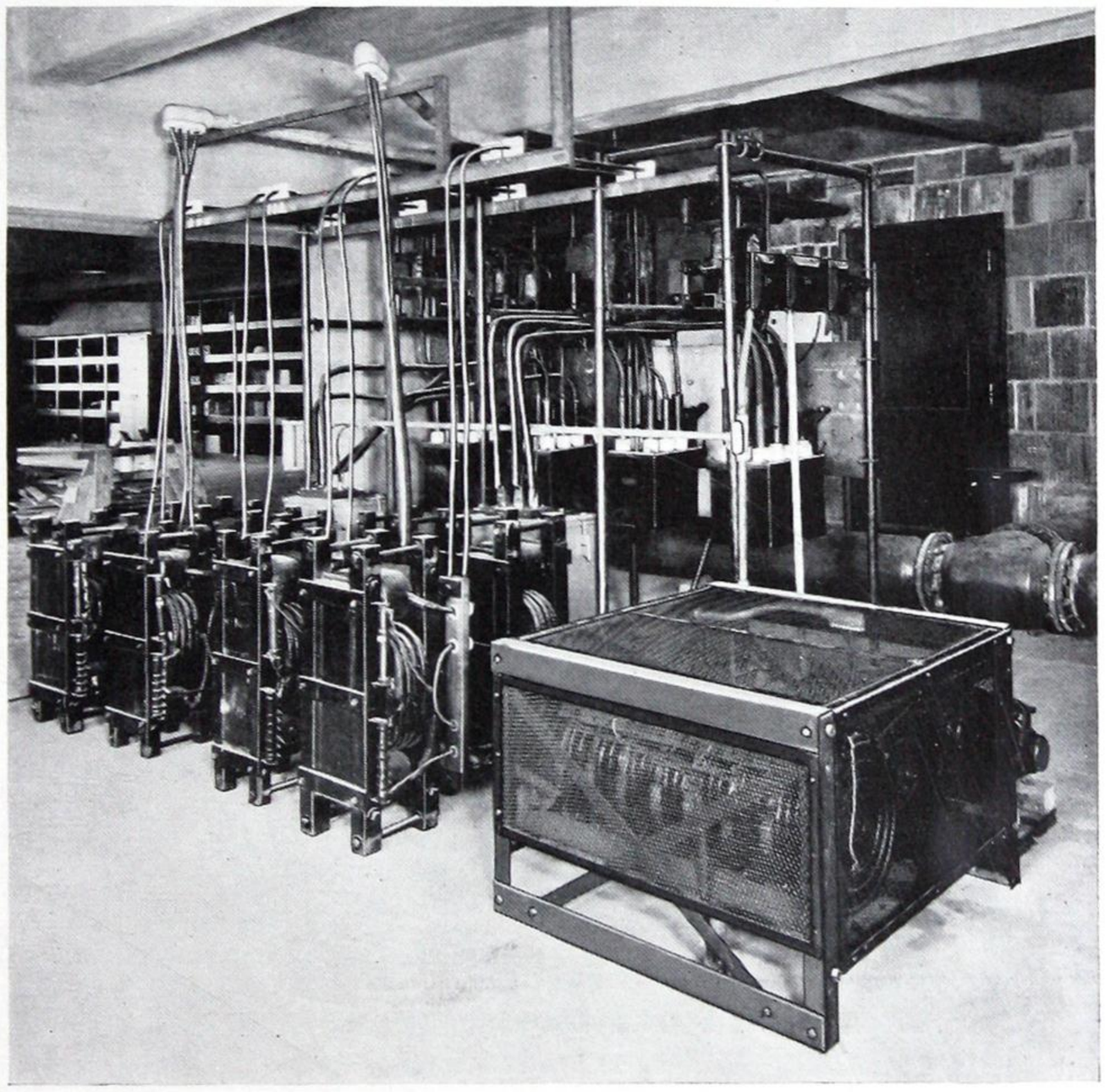


FIGURE 8.

Group of reactance dimmers controlling colored floodlighting on the Philadelphia Electric Building. The resistance dimmers in the foreground control the reactors on the left. These, in turn, dim the circuits as described in the specifications.

The reactance dimmer consists of a magnetic element and a control resistance in the form of a dimmer plate. The elementary idea of the Ward Leonard construction is shown in Figure 9. The magnetic element has three paths, A, B, and C as shown. Magnet coils wound on paths A and C control the lamp current. The magnet coil on path B connects to the control dimmer plate and is operated on a direct-current circuit.

The lamp circuit must be connected to an alternating-current supply. When the magnetization of the direct-current coil is at its maximum, the paths A, B, and C are saturated. The alternating current therefore can not induce any voltage in windings A and C, and since the lamp voltage is equal to the line voltage minus the reactor voltage, the lamps are therefore bright. When the direct current magnetization is at a minimum, the paths A, B, and C are practically unsaturated. This allows the alternating current to saturate paths A and C, and induce a voltage in its own windings A and C. Hence the reactor voltage is at a maximum and the lamps are dim.

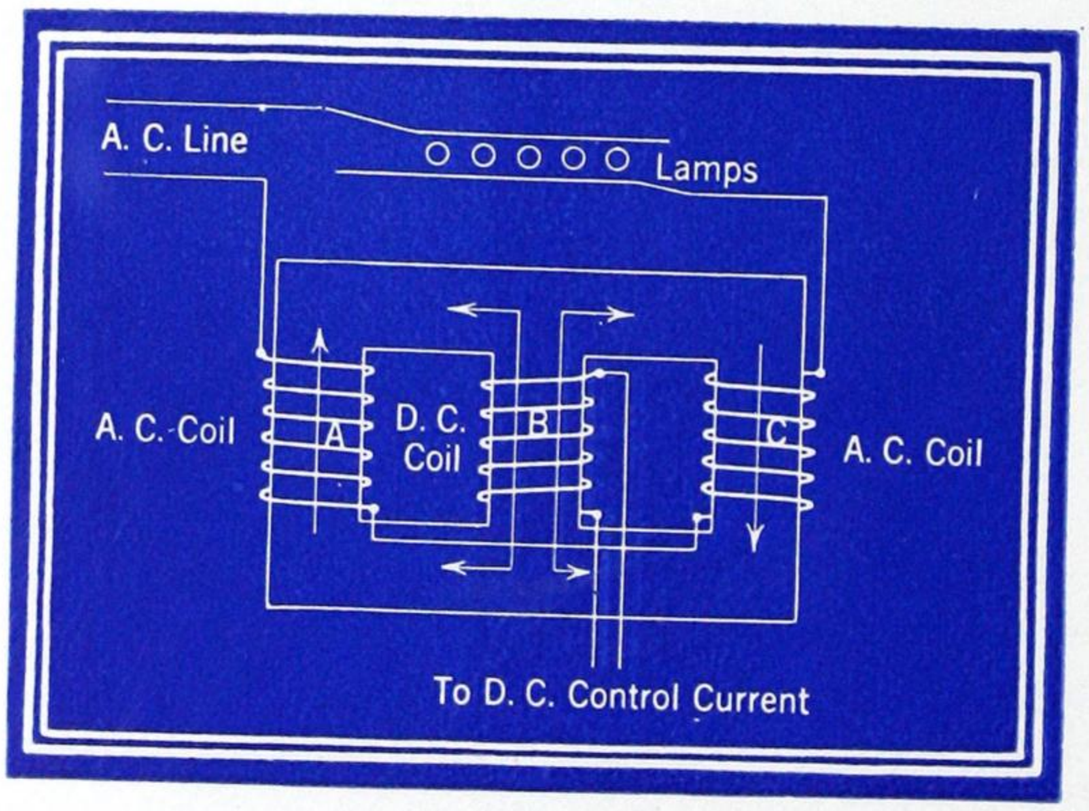


FIGURE 9.
Elementary sketch of reactor construction and wiring of circuits.

It will be seen from the above that both alternating and direct current are needed. It is also advisable to use booster transformers to compensate for the voltage loss in the reactors (10 volts at bright point of lamps) unless the incoming voltage is high enough to use standard lamps of a voltage equal to the line voltage less ten volts. In this type of dimmer one 17″ round dimmer plate will control up to 30 KW. of load because of the fact that the D.C. control current is very small.

Ward Leonard engineers will be glad to go over proposed floodlighting layouts and make recommendations on control equipment. The following information should accompany inquiries:

1. Building construction detail.
2. Contemplated wattage and lighting equipment for each section of the building.
3. Whether circuits will be kept within 5000 watts maximum rating to use B.D. dimmers, or whether the reactance type is preferred.
4. Whether two wire or three wire circuits.
5. A.C. line voltage, if available.
6. D.C. line voltage, if available.
7. Lamp voltage.
8. Frequency and number of phases of A.C.
9. State whether neutral is brought through solid to load.
10. Sketch of proposed color cycle.
11. Time for complete color cycle.
12. Number of colors.

Attention is called to an installation of the Philadelphia Electric Company on their new Edison Building. See Figure 10.

The reactance type dimmer was used. A motor generator set was installed to provide the D.C. needed. Booster transformers were also used to compensate for reactor and line

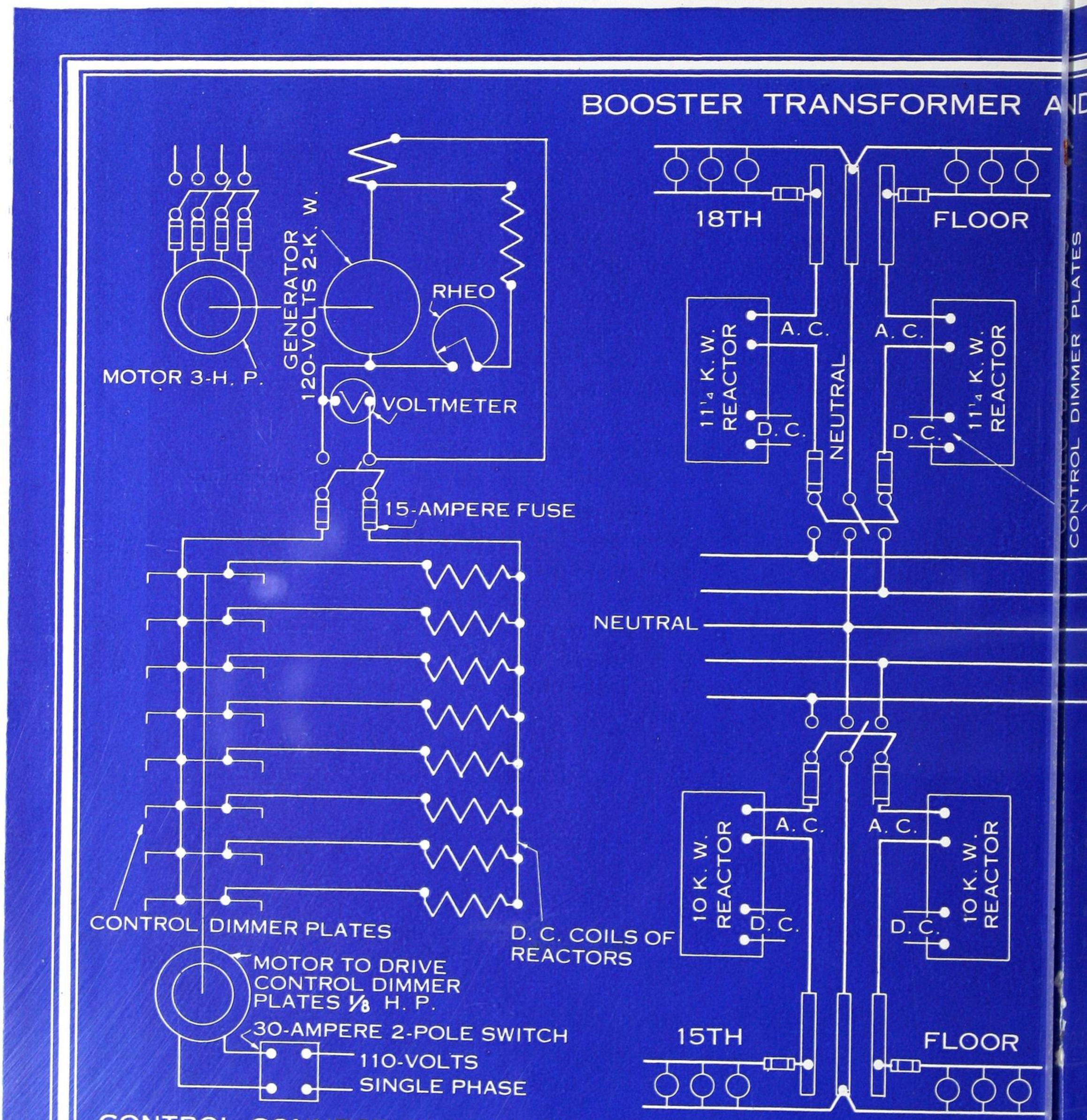
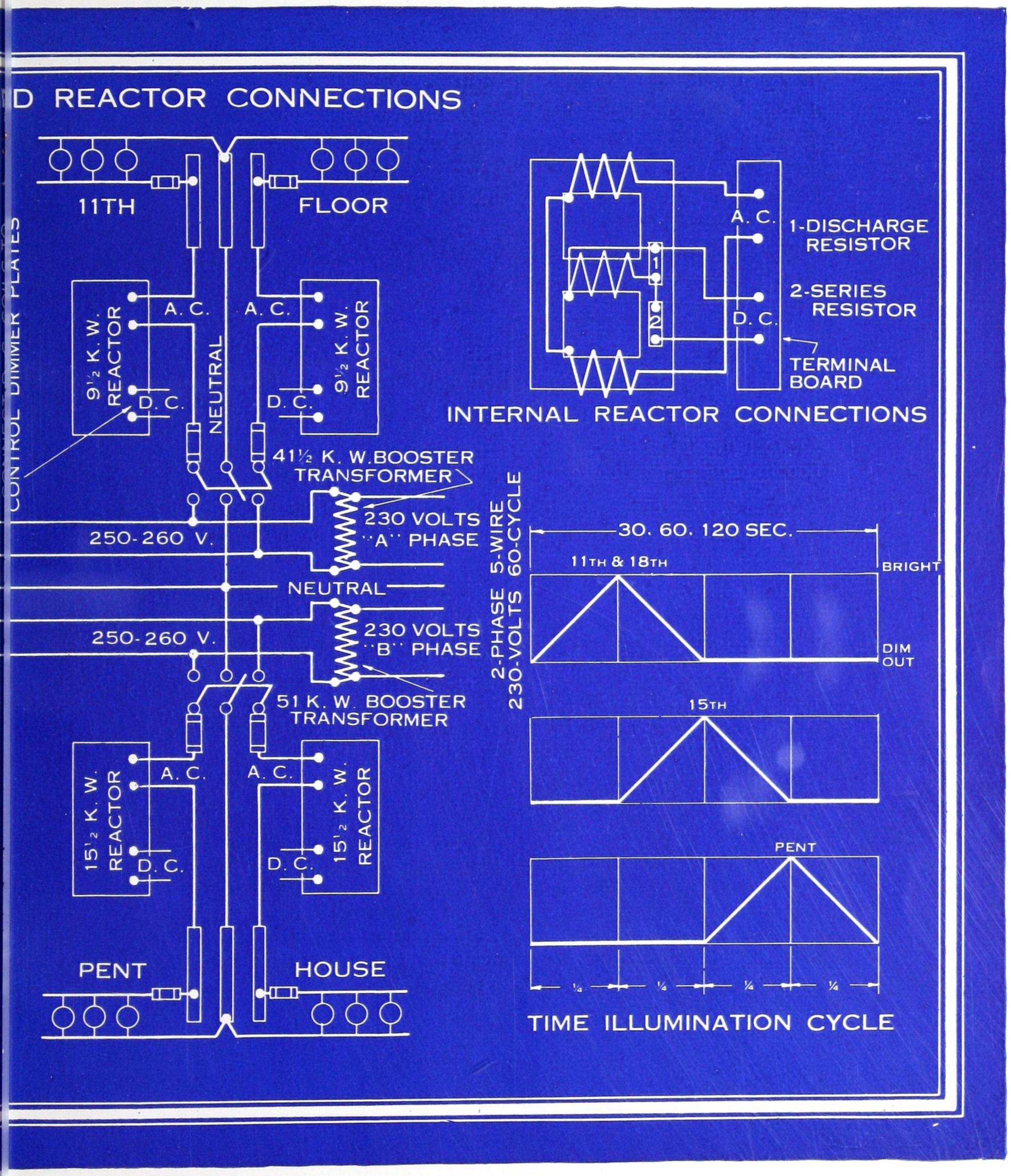


FIGURE 10

Wiring diagram of floodlighting control i [illegible] *alled in*
ing. The color cycle is also indicated. Th [illegible] *ime fo*



RE 10.

led in the Philadelphia Electric Company Build-
ne for this can be either 30, 60, or 120 seconds.

losses in voltage. The upper stories or pent houses were illuminated in deep red, the sides in blue, and the corners in green. The color was left on constantly, and the change effected by washing out the color with white light. The illumination of this building has caused favorable comments by everyone who has seen it.

To assist in similar installations the specifications* for the floodlighting are reproduced here.

SPECIFICATIONS OF THE MOBILE COLOR LIGHTING CONTROL EQUIPMENT

SECTION 1.

ARTICLE 1. These specifications are intended to cover proposed floodlighting installation for the new building at the above address.

ARTICLE 2. All outlets are located approximately but the exact location will be determined by the Building Manager or his representative.

ARTICLE 3. All material used must be licensed material and the wiring contractor will guarantee all work and material for a period of one year from the completion of the work.

ARTICLE 4. All work will be installed in a first class manner and according to the rules of The Philadelphia Electric Company and the Philadelphia Fire Underwriters' Association whose certificate of approval will be furnished upon completion of the work.

SECTION 2.

ARTICLE 1. *Eleventh Floor—Roof of Edison Building*—Install forty-eight 1000 watt floodlighting projectors in two banks as shown on plan similar to Pittsburgh FLC 1000. Projectors must be of the narrow beam type, and equipped with 1000 watt P.S. Mazda lamps. Main beam not to exceed 10 degrees. Sixteen of these projectors to be equipped with clear lens. Angle of throw and beam divergence to be so adjusted as to evenly illuminate the west side of the building from the eighteenth to the twenty-second floors, with an even distribution of white light.

*Specifications furnished by Lighting Service Section, Philadelphia Electric Co.

These banks of units to be connected with same dimmer unit which controls the white light on the eighteenth floor level.

Thirty-two projectors shall be connected directly to the circuit and equipped with a suitable spread lens and inside color glass capable of projecting light on the same area of the west side as above, so controlled that two stories may be illuminated in one color and the adjacent two with another color and have a fairly definite line of demarcation.

The above projectors shall be mounted in two banks having three rows of eight projectors each, on a suitable steel framework standing as high above the Edison Building as structural limitations will allow. The color banks shall be mounted on the two top rows. The steel framework shall be large enough to accommodate three projectors in each row should future conditions make such addition desirable.

At each end of the west wall of the Edison Building install a 1500 watt incandescent searchlight and connect in with the same dimmer unit with the clear lights. These searchlights to be so adjusted as to minimize the shadows in the upper portions of the building which cannot be covered by nearby projectors.

ARTICLE 2. *Fifteenth Floor*—Install 120 floodlighting projectors as shown on plan, similar to Pittsburgh projector FLC 500 and equip with 500 watt Mazda lamps. Divergence of the main beam shall not exceed 10 degrees.

Forty of the above units shall be equipped with clear lens and connected to one unit of the main dimmer.

Eighty of the above units shall be connected directly to the circuit and equipped with glass color caps similar to Laco-Phillips No. 3.

ARTICLE 3. *Eighteenth Floor*—Install 137 floodlighting projectors as shown on plan similar to Pittsburgh projector FLC 500 and equip with 500 watt Mazda lamps.

Forty-five of these projectors shall be equipped with clear lens and connected to the same dimmer unit as the white lights on the roof of the Edison Building.

Ninety-two of these projectors shall be equipped with glass color caps similar to Laco-Phillips No. 3, and connected directly to the circuit.

All projectors at this level shall be mounted on a suitable steel framework to bring them as near the top of the parapet as possible.

ARTICLE 4. *Penthouse Floor*—Install 162 floodlighting projectors as shown on plan, similar to Pittsburgh FLC 500, and equip with 500 watt Mazda lamps.

Sixty-two of these projectors shall be equipped with clear lens and connected to one unit of the main dimmer bank.

One hundred of these projectors shall be equipped with glass color caps similar to Laco-Phillips No. 3 and connected directly to the circuit.

ARTICLE 5. *Penthouse Roof*—Install 14 vapor-proof prismatic units as shown on plan similar to Holophane No. 02338 and equip with 200 watt Mazda lamps. All projectors to be equipped with glass color caps similar to Laco-Phillips No. 2-A and be connected directly to the circuit.

SECTION 3.

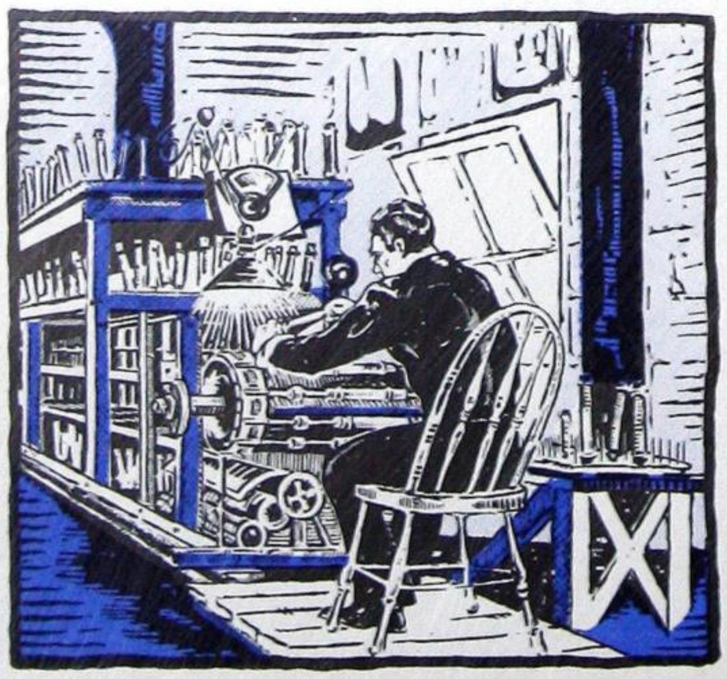
ARTICLE 1. *Projectors*—All 500 watt projectors must be able to accommodate glass color caps without spill shield or special attachment. Any unit submitted for consideration must be accompanied by E.T.L. photometric curves showing candle power distribution in two perpendicular planes.

ARTICLE 2. *Color Equipment*—Color equipment both in the 1000 watt and 500 watt sizes must be able to burn, lens up, with blue color attachment and resist breakage due to rain.

ARTICLE 3. *Control Equipment*—On machinery floor install a motor driven reactor dimmer as manufactured by the Ward-Leonard Electric Co. (or equal) to control the above circuits.

ARTICLE 4. *Adjustment*—The company furnishing the projectors must also furnish the services of a lighting engineer who is thoroughly experienced in color floodlighting who will adjust the equipment under the direction of an engineer of the Lighting Service Department of the Philadelphia Electric Company.

In addition to the lighting specifications there were dimmer control specifications which are reproduced below.



REACTOR DIMMER CONTROL SPECIFICATIONS

GENERAL:

1. These dimmer elements shall be of the reactance type, wherein the permeability of the iron core is varied through changing the amount of uni-directional flux by means of changes in direct current excitation. The magnetic circuit shall be so arranged that the alternating flux does not thread (or, is balanced in) the direct current coil and the uni-directional flux does thread the reactance coil.

DUTY:

2. These dimmer elements, used on a 60 cycle circuit with the two booster transformers hereinafter described, shall be capable of regulating the lamp voltage from full bright to black out when carrying their rated load of type C lamps. The direct current coils are to be designed for operation on a 120 volt circuit, and to give exactly 115 volts on the lamps when the reactor is hot.

RATING:

3. These dimmer elements shall be air cooled dry type. They must carry their rated load continuously with natural air circulation without exceeding a temperature rise of 55° C. above the surrounding air. The temperature and insulation test shall be in accordance with the standardization rules of the A.I.E.E. The efficiency of these dimmer elements or reactors, when operated at rated load, at their continuous duty temperature and at full illumination of 115 volts on the lamps, shall not be below 95 per cent on 60 cycles. The efficiency is the ratio of the wattage output to the lamps, to the total wattage input, including both the alternating current input, and the direct current input.

SIZE AND QUANTITY:

4. The reactor dimmers shall control white light only and be suitable for 2 wire loads. The quantity and ratings are as follows:

2 - 9½ KW. 2 wire for 11th floor
2 -10 KW. 2 " " 15th floor
2 -11¼ KW. 2 " " 18th floor
2 -15½ KW. 2 " " Penthouse

SERVICE AND BOOSTER TRANSFORMERS

5. The service available is two phase 60 cycle, 230 volts with five wire distribution. Each phase is to be used with the fifth wire

which is the neutral to form a single phase 3 wire 115 - 0 - 115 volt service.

Two booster transformers will be required to provide the necessary increase in voltage to compensate for the fixed impedance of the reactors so that standard 115 volt lamps may be used in all dimmer circuits. These transformers shall be oil insulated, self cooled type, designed for a normal supply voltage of 230 volts 60 cycle. Each transformer shall be provided with taps so that the output voltage can be adjusted to 250, 255, or 260 volts. As these transformers will be used with a common neutral, the boost must be arranged equally on each side of the neutral.* The boosters shall be designed for the following lamp loads:

1 - 41½ KW.
1 - 51 KW.

The transformers shall meet the temperature and insulation requirements as recommended by the American Institute of Electrical Engineers.

MOTOR DRIVEN CYCLE CONTROL DIMMER

6. A motor driven cycle dimmer shall be furnished to control the four sections of white floodlighting, by controlling the excitation of each reactor. There shall be one control plate for each reactor and each pair of reactors controlled by one cam. The motor shall be for single phase 115 volt 60 cycle service. A chain drive shall be furnished with several sets of sprockets so that a complete light cycle may be made in 30, 60, or 120 seconds by merely changing the sprockets and chains. The light cycle shall be as indicated in general wiring diagram.

MOTOR GENERATOR SET

7. A motor generator set shall be furnished. The motor is to be for 2 phase 4 wire 230 volt 60 cycle and provided with a hand starting switch. The generator is to be rated 2.0 KW. at 120 volts D.C., and maintain constant voltage up to full load. A field rheostat is to be furnished to adjust the output voltage to the desired value.

Figure 8 shows the dimmer controls. Each section of the building was controlled by a separate switch, which controlled two reactors, one on each side of a 3 wire circuit. Each reactor was controlled by a dimmer control plate mounted on the motor driven cycle dimmer shown in the foreground.

*The schematic wiring diagram on pages 24 and 25 gives the wiring connections and color cycle used in this installation.

Mobile Color Lighting

Its Application to Illuminated Outdoor Signs

The Electric Sign

THE USE of the electric sign for publicity purposes was practically coincident with the development of the incandescent electric lamp. Today, almost every form of business employs these signs in one form or another and the annual current consumption employed in illuminating them is enormous.

Electric signs are somewhat more impersonal than other publicity mediums: One may look or not, depending upon the sign's location, its attractiveness, and other conditions. For that reason, signs must be placed with care, illuminated so that their message may be obtained easily, and be distinctive. The choice of the type of sign employed must be governed chiefly by location. A sign on Broadway between 40th and 50th streets in New York City would have to be very unusual in illumination and subject matter to attract attention from the tremendous amount of similar publicity adjacent to it. A sign on an unilluminated highway, for

Limitation in Design and Placement

example, could be far more detailed in its message and would attract a large percentage of those passing with a far smaller amount of illumination.

Signs are divided into five general types:

Types of Signs

1. Signs having the outline of the message formed by lamps external to the supporting or reflecting surface.

2. Signs in which the message is outlined by channels which may or may not be covered with opal glass. The lamps in these signs are located in the channels.

3. Signs in which the lamps are concealed behind opaque letters or designs. These signs are usually classified as the "outline" type, and are silhouetted against the background,

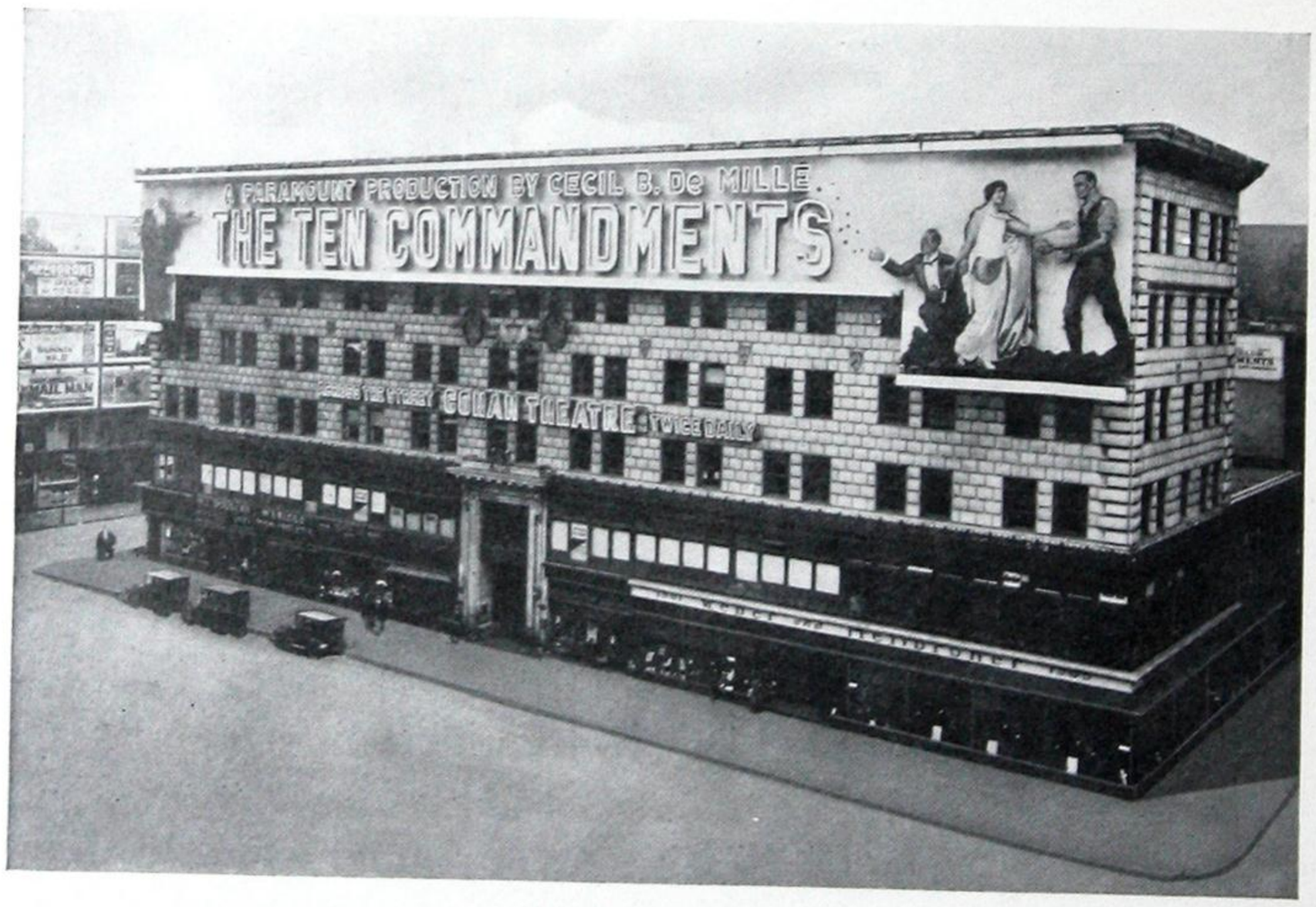


FIGURE 11.

Large electric sign illustrating the possibilities of motion and color on a large electric display. This sign combines several principles of construction. The control dimmer is illustrated in Figure 12. The description is given in the text.

which is illuminated by the lamps. The letters, therefore, should be dark to afford contrast.

4. The illuminated poster type sign in which the message is usually painted on the surface of the reflecting medium.

5. Signs which combine all or any part of the four preceding types. These signs are usually quite comprehensive in their message and are frequently used for the actual display of merchandise such as furniture and automobiles in conjunction with other sign type combinations.

In a number of recent installations the flashers have been equipped with a series of properly proportioned Vitrohm resistors to produce a smooth change in intensity and increase legibility. Another method is to use a continuously rotating Vitrohm dimmer (Fig. 2). The sign can be divided into a number of parts and each part brought to full bright individually to emphasize their message.

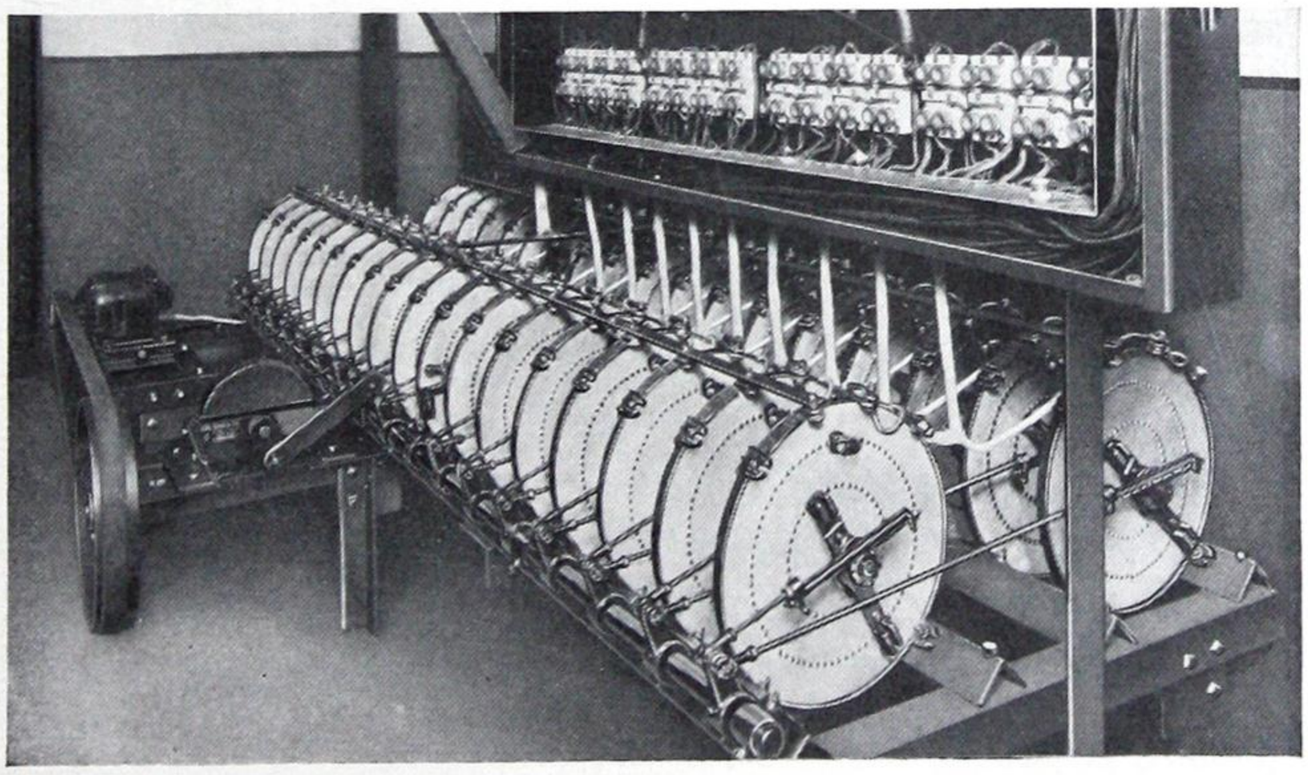


FIGURE 12.

Motor driven cycle dimmer for controlling the "Ten Commandments" sign. In this case, a crank instead of cams was used to move the dimmer levers.

Attracting Attention In order to attract attention to the sign, it is customary to use a flasher to flash the light on and off. This gives the sign motion but makes the sign more difficult to read. It has been found that by dim flashing signs the message is much more legible and eases the strain on the eyes.

Under type 2 is found the glass letter sign with light behind the letters. Through the use of appropriately placed color screens the colors of the letters on the sign may be changed from one end of the spectrum to the other and produce a very delightful and artistic effect. The change in color is made with the aid of a continuously rotating dimmer (Fig. 2), or a larger cycle dimmer (Fig. 12) where very special effects are desired.

Under type 4 is found the sign painted in such a way as to reflect one message under red light and a second message under blue light. The transition from the red to the blue light may be made with the aid of dimmers. There are great possibilities for striking and attractive effects with such equipment.

An outstanding example under type 5 was the "Ten Commandments" sign. This sign carried 200,000 watts, of which 100,000 was dimmed and brightened with a dimmer as shown in Figure 12.

The cove lighting at the top and bottom was in amber. The line "A Paramount Production by Cecil B. De Mille" was in red. These circuits were constant without dimmers. The large letters "The Ten Commandments" were illuminated in white and constituted one-half the total load. These letters were controlled by the dimmers on a twenty second cycle.

The Ward Leonard engineers will be glad to provide specifications for obtaining special sign effects. Sign manufacturers and flasher manufacturers are particularly invited to outline their problems.

Mobile Color Lighting

Its Application to Interior Display

THE use of mobile color lighting as an adjunct to schemes of interior decoration has met with widespread favor with the operators of restaurants, roof gardens, cabarets, and other places of public meeting where unusual lighting effects have a definite value in creating "atmosphere."

The mechanical equipment and much of the other information given in the chapters on "Window Display" and "Natural Phenomena" will be of interest in connection with the use of mobile color lighting in these applications.

Department and specialty stores, too, are finding the use of mobile color lighting a distinct aid in the presentation of certain classes of merchandise, as well as utilizing it as a straight "display" proposition.

Light is employed in stores for two important reasons: First, for the adequate display of merchandise, and for the convenience of persons in the store; second, for decorative purposes.

Mobile Color Lighting in the Store

Obviously the first function of store lighting is most important and in no case should adequate general illumination be sacrificed to secure novel effects, however worthy those effects are in themselves.

It therefore follows that the use of mobile color lighting in store display work calls for careful consideration of purpose, advantages, and limitations.

The Stage as an Example

Certain problems met with in the lighting of a play for stage presentation closely parallel those met with in merchandising.

The stage employs lighting as a most effective medium and a necessary requisite for securing the illusion of reality and force in its scenes. Mobile color lighting is employed carefully; its application is definitely limited and it never occupies a position of such importance that it attracts attention to the detriment of the main action. The exception to this rule is where light is employed, as it very frequently is, as a decorative feature in itself.

Store display managers will find that mobile color lighting offers them the same advantages that it does the theatre, and that it must be employed as carefully. Its purpose in the store should be as an attraction in itself, as a purely decorative medium, or to produce an effect appropriate to a desired atmosphere. The two purposes should be kept distinct.

Limits of Application

Definite Uses

The list below gives a part of the application of mobile color lighting in store displays. Other uses will, of course, arise in the course of the store's operation.

1. Women's departments where the background for display might be unusual. Departments carrying gowns, hats, undergarments and jewelry are especially suggested.

2. Furniture departments, particularly where house interiors and complete groups of furniture or furnishings are shown. Here, color lighting, both static and mobile, is almost essential to secure an impression of reality.

3. Sporting goods departments, where complete outdoor scenes and other displays require natural treatment.

4. Jewelry and other departments where it is desirable to simulate conditions under which the merchandise might normally be used.

5. Prominent store positions for special events. Here mobile color lighting must be used for its own merit; that of attracting attention because of its decorative features. The illumination of fountains, auditoriums, and other special points would be included in this division.

6. Restaurants and other places used by the public where patronage is decided to a considerable extent by an unusual "atmosphere."

Mobile color used in these divisions should be used to furnish an appropriate atmosphere; not as a strictly decorative medium.

Specifications and Design Data

These applications will vary so widely in physical characteristics, that no definite recommendations can be made to cover the engineering specifications. The control of the light intensity and color can be obtained by the use of a cycle dimmer as described on Pages 12 to 15 and shown in Figures 2 and 4. Anyone contemplating such installations and desiring information as to specifications can secure it through Ward Leonard engineers.

Mobile Color Lighting

Its Application to the Illumination of Natural Phenomena, Gardens, etc.

From what has already been said about its many applications, it is not surprising to learn that mobile color lighting is finding widespread use as an aid in beautifying natural scenery at night.

The Natural Bridge of Virginia

One of the most ambitious and successful uses of mobile color lighting in this field is the Natural Bridge of Virginia. This project, completed in June, 1927, had for a background a natural limestone bridge over a great gorge through which flows a small stream.

The principal care in designing the lighting was to prevent any appearance of "cheapness" by the indiscriminate use of light. That the project was a success, and that the use of mobile light permitted appreciation of the Bridge's beauty at night as well as by day is attested by this excerpt from an editorial printed in the *Richmond Times* of June 6, 1927:

"And that is only a small part of what is done to make the Natural Bridge visible at hours when otherwise it would be invisible. With this same almost reverential blend of science and art, the sun is made to rise and its glow—always there is a glow—is made to rest on the top, where the little stunted, twisted trees grow, and then to rise until the top of the arch is bathed in soft, new light. Through the huge span, at another time, a glow spreads and . . . It's all done as perfectly as anything can be done—by man."

FIGURE 13.

Caves, Waterfalls, Gardens, etc. Gardens, parks, hotel grounds and private estates can often use mobile color lighting to advantage. By means of floodlighted trees and shrubbery, such places can be made most beautiful by night. The autumn colors are enhanced by such treatment, and snow-covered shrubbery in winter can be transformed into a delicate mass of changing color. The garden illustrated

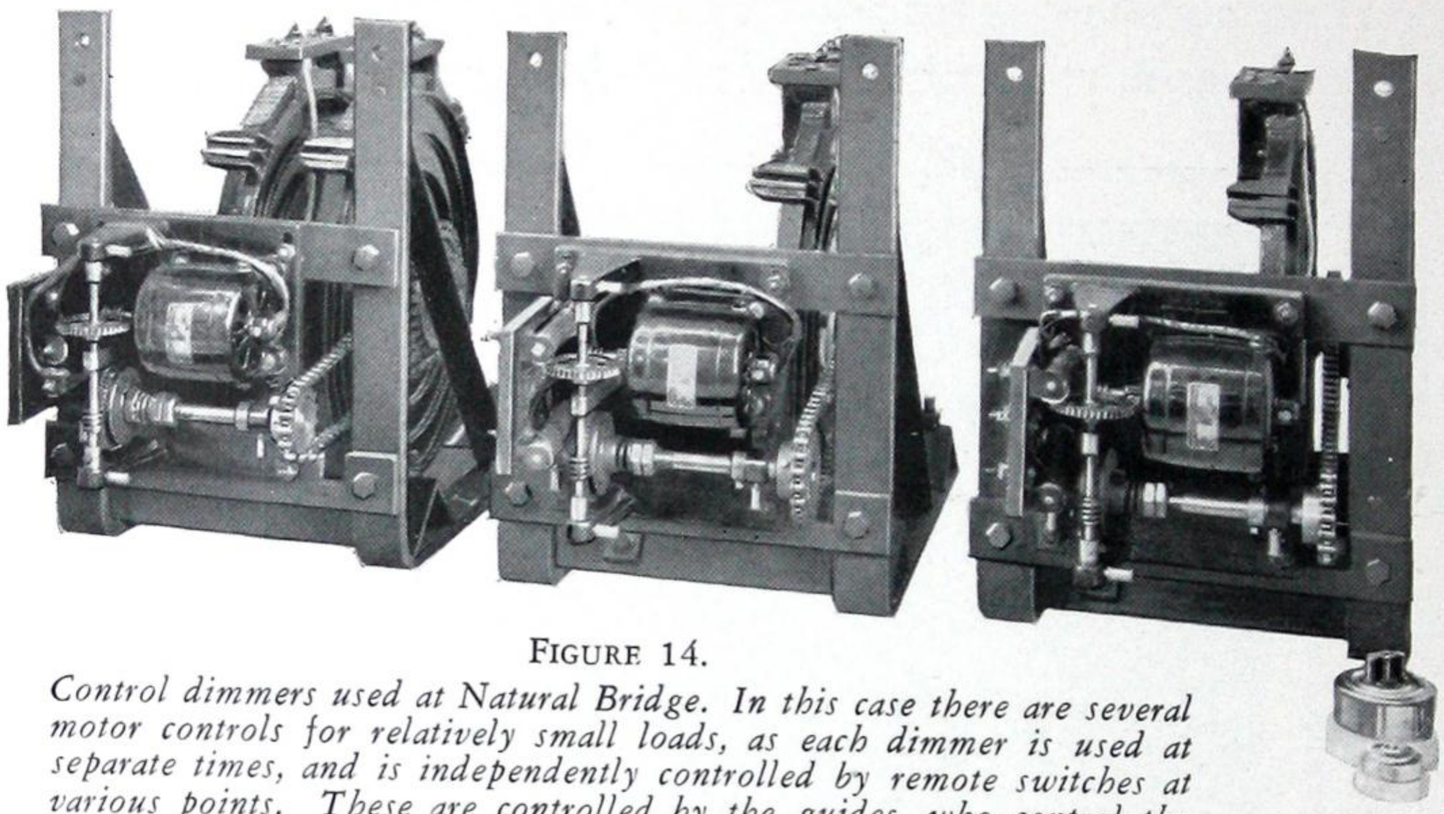


FIGURE 14.

Control dimmers used at Natural Bridge. In this case there are several motor controls for relatively small loads, as each dimmer is used at separate times, and is independently controlled by remote switches at various points. These are controlled by the guides, who control the lighting as they proceed.

in Figure 16 represents such an installation. The photograph cannot do justice to the effect produced, which makes the garden fully as attractive by night as it is in a different way by day.

Such places, as well as public buildings and institutions can use this lighting to special advantage at Christmas time. The decorative floodlighting schemes so well carried out of late years, and applied to Christmas trees, building facades and public squares take on the added interest of motion when equipped for mobile lighting.

Caves and waterfalls, along with other natural phenomena such as the one just described, lend themselves admirably to such treatment. One has but to see Niagara under its cloak of ever changing color to realize what can be done.

The Illumination of Fountains

Illustrated in Figure 15 is the Clarence Buckingham Memorial Fountain in Grant Park, Chicago. The fountain is made for two types of displays; day and night. For use by day it is a graceful and beautiful fountain set in a formal garden which accentuates the spirit of the design. By night, for the major display, the fountain becomes a mist of colors which in their beauty are difficult to describe adequately.

FIGURE 15.

Under water floodlighting in mobile colors is used for the illumination of the various streams of water. As control is had over both the intensity of light and the volume of water, control of color effects is extraordinarily complete.

The main, or central portion of the fountain, which is illustrated, consists of three basins rising one above the other. The lower basin is 300 feet in diameter, the second 110 feet, the third and top basin 24 feet in diameter.

The jets of water spout from the outer rim of each basin towards the center and converge at the rim of the next higher basin, forming diminishing domes of water.

The apex of the top dome contains eight jets arranged around one geyser jet which throws a column of water more than 90 feet upward.

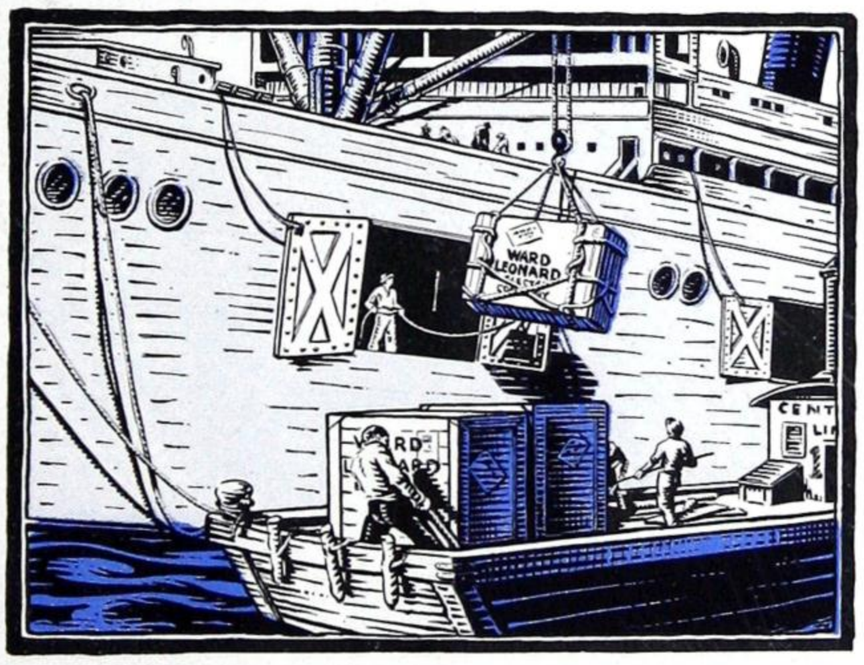
FIGURE 16.

Four pairs of bronze sea horses, the design of M. Loyou, French sculptor, are placed around the major basin. Streams of water from the mouths of the horses converge towards the fountain itself.

This display is one of the most interesting of Chicago's civic improvements and each night, during the warm months, attracts hundreds of spectators.

The Ward Leonard Vitrohm Dimmers installed for this display are the standard type described in this Bulletin.

The equipment for the illumination by mobile lighting is almost always special, and no fixed specifications can be drawn. The engineering department of Ward Leonard is available for drawing up specifications to suit individual requirements.



TYPICAL WIRING DIAGRAMS

(No Plates in Parallel. Dimmers in the Neutral)

Two Wire

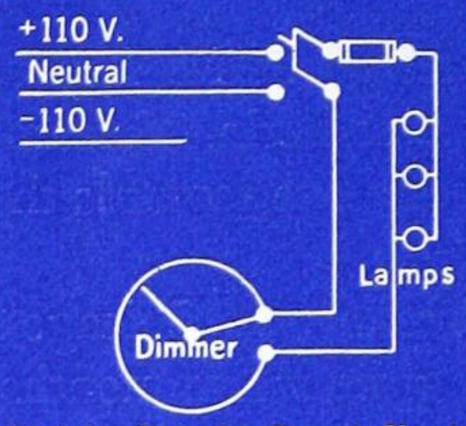


Fig 1-One Plate, One Branch Circuit

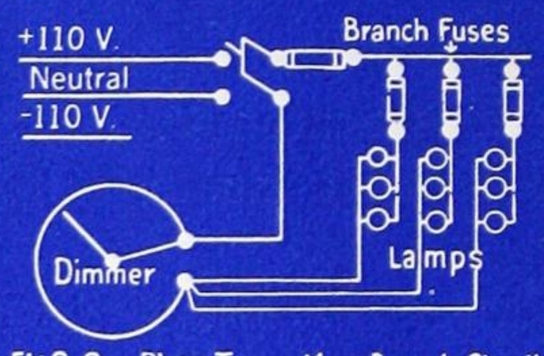


Fig 2-One Plate, Two or More Branch Circuits

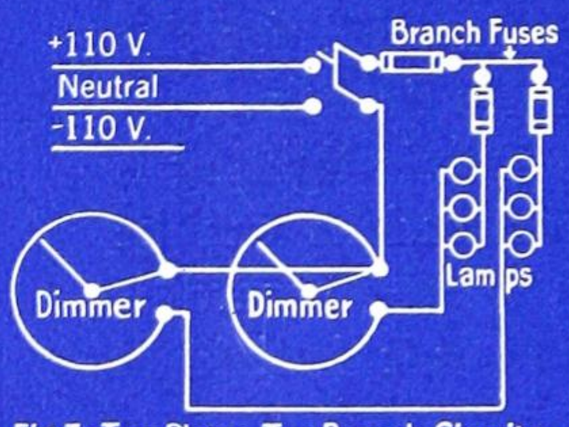


Fig 3-Two Plates, Two Branch Circuits

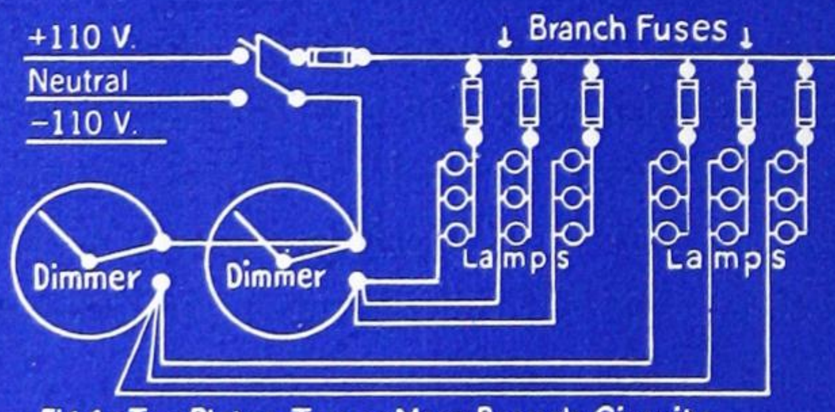


Fig 4-Two Plates, Two or More Branch Circuits

Three Wire

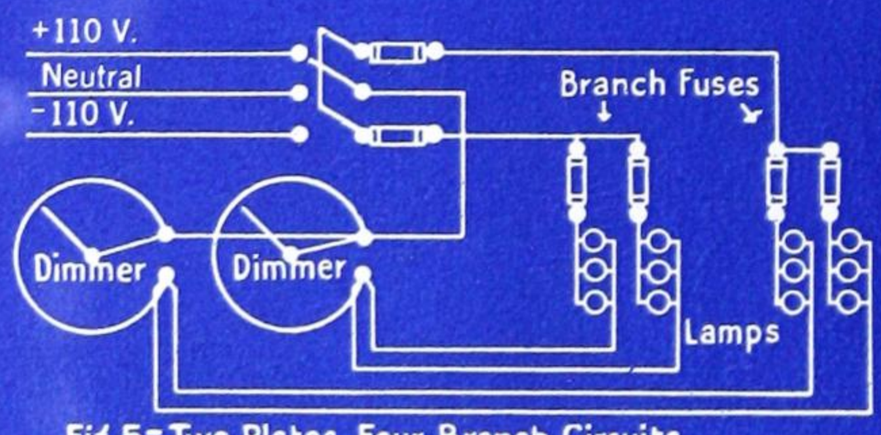


Fig 5-Two Plates, Four Branch Circuits

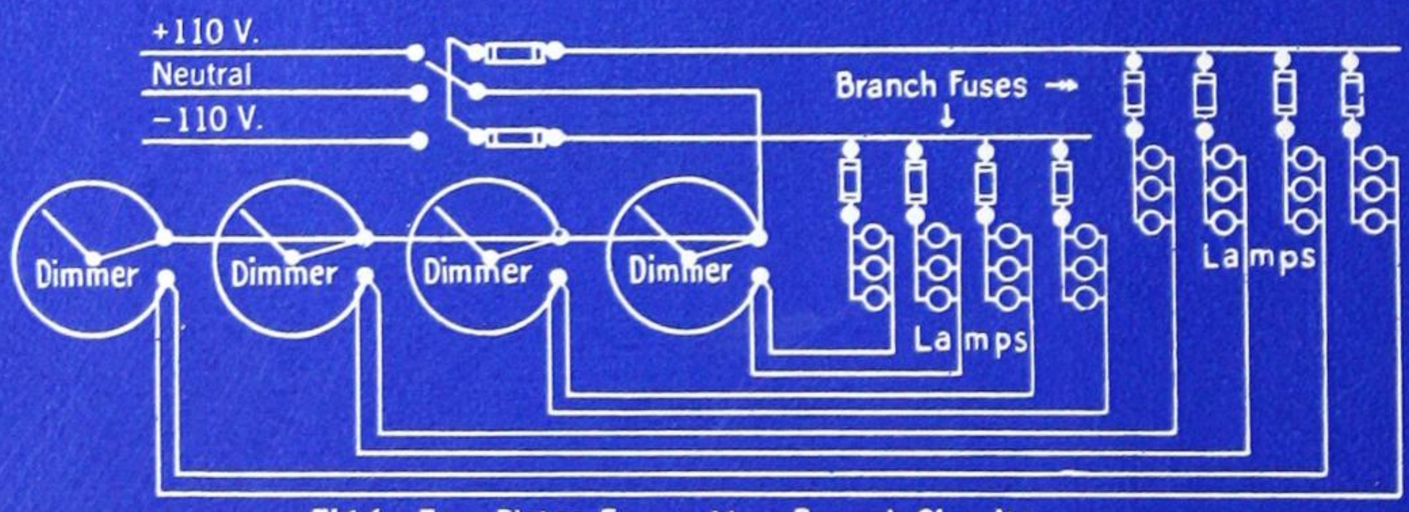


Fig 6-Four Plates, Four or More Branch Circuits

FIGURE 17.

Wiring diagram illustrating how paralleling of dimmer plates is avoided. See Bulletin 72 for further information.

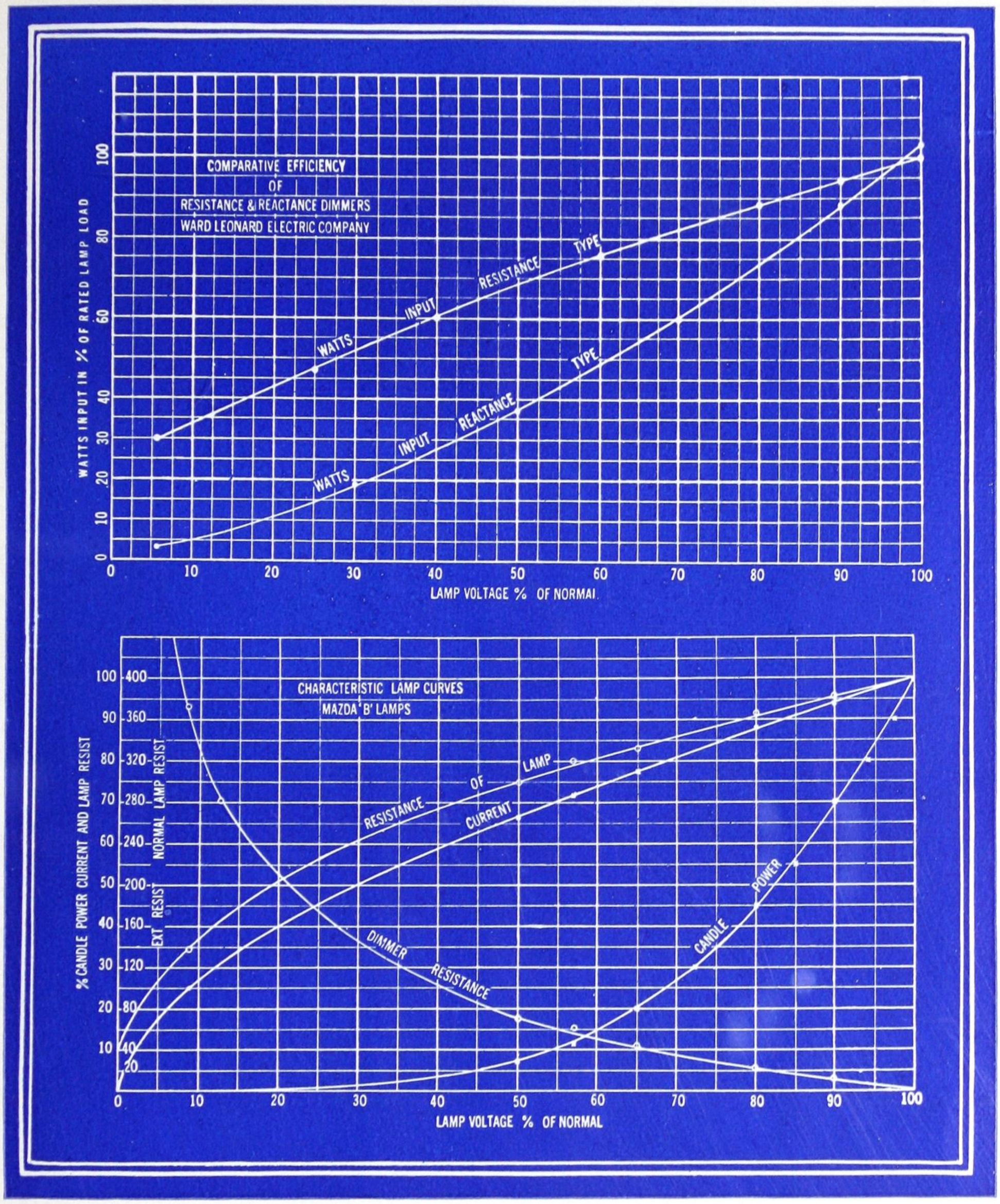


FIGURE 18.

The curve above shows the comparative efficiency of resistance and reactance dimmers with varying voltages at the lamp. The curve below shows various Mazda lamp characteristics at different voltages. It will be noted that a distinct saving in energy can be effected by the use of reactance dimmers, so that they are especially desirable in installations where they are in service for long periods of time.

The illustration of the Clarence Buckingham Fountain, page 41, is copyrighted by Henry Fuermann & Sons, Chicago, and is used through their courtesy.

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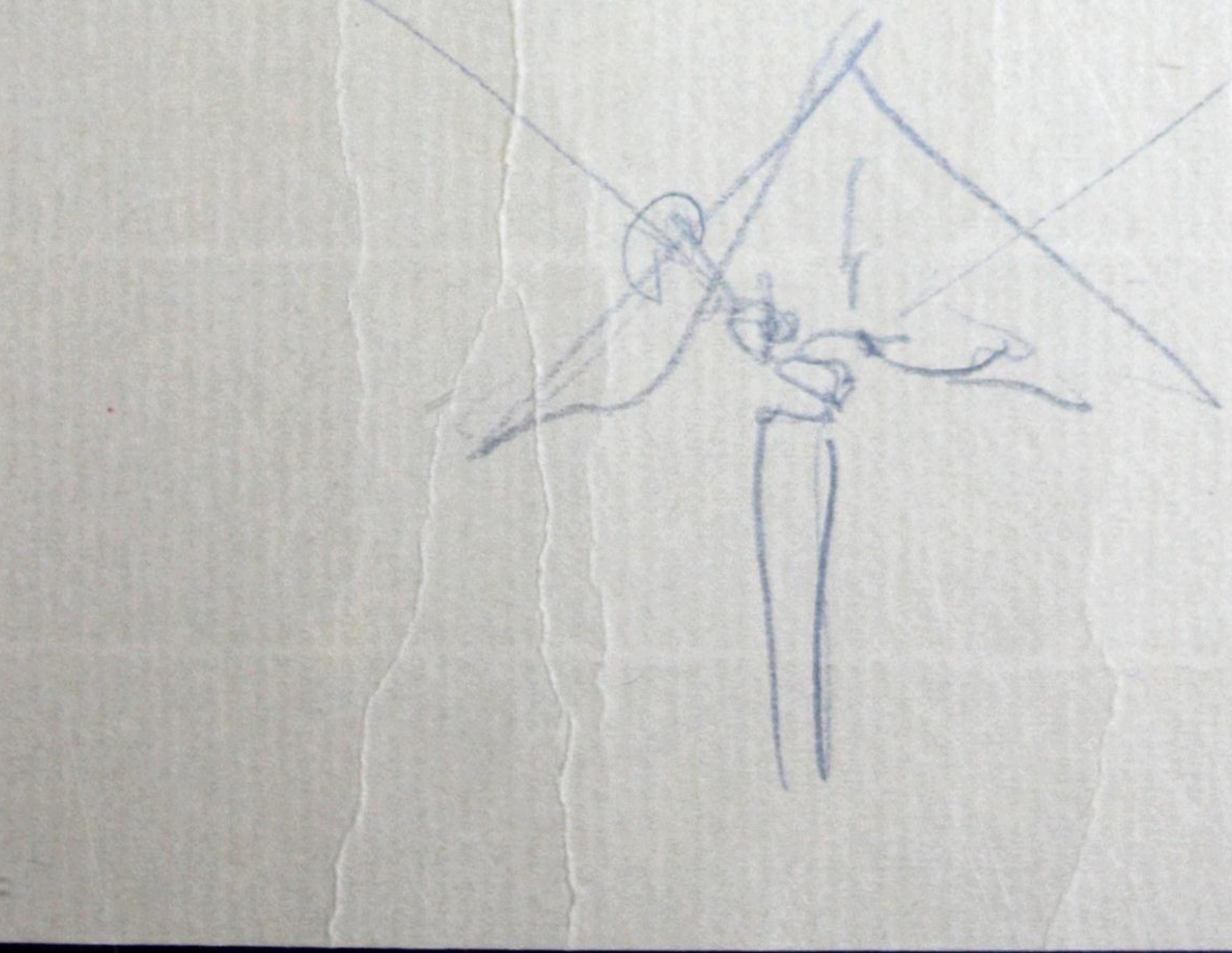

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